ENGIN STORAGE

PROVINCE OF QUEBEC, CANADA

Department of Colonization, Mines and Fisheries

BUREAU OF MINES

Honourable J. E. Perrault Minister, : : L. A. Richard, Deputy-Minister
Theo. C. Denis, Superintendent of Mines

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REPORT ON

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

Engineering

DURING THE YEAR 1921

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1922

PROVINCE OF QUEBEC, CANADA
Department of Colonization, Mines and Fisheries
BUREAU OF MINES
Honourable J. E. Perrault Minister, : : L. A. Richard, Deputy-Minister
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IN THE
PROVINCE OF QUEBEC
DURING THE YEAR 1921

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1922

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NOTE

In the statistical tables and in the review of the mining industry, of the Province during the year, the term "production" is synonymous with "quantity sold or shipped," and does not necessarily represent "output." The ore and other mineral products remaining as "stock on hand" at the end of the year are not included in the production figures.

The ton used throughout is that of 2,000 lb. except when specially mentioned.

The year referred to is the calendar year, ending December 31st unless specially stated.

We endeavour to give values of the mineral products, raw or prepared, as estimated at the point of shipment or at the pit-mouth ; this, however, is sometimes difficult to obtain.

The present report was preceded, on February 20th, by a statistical statement on the mineral production in 1921, giving provisional figures, subject to revision. The present report gives the revised statistics. and the tables in this volume supersede those of the preliminary statement.

Bureau of Mines,
Quebec, April 28th, 1922.

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING THE YEAR 1921

STATISTICAL REVIEW

The year 1921 has been lethargic as regards mining in the Province of Quebec. The value of the mineral production amounted to a total of $15,522,988, as compared with $28,392,939, for the preceding year 1920. We therefore record a decrease of $12,869,951, or 45.3%. This is the lowest figure of annual production since 1915, when it was $11,465,873.

One year ago there were unmistakable signs that adverse times were coming, and that we were on the brim of an industrial depression, but it was hardly expected that it would be as serious as it eventually developed, and that it would affect our mining industry to the extent of reducing the value of its output by almost one half in 12 months. For one year or more all industries have been stagnating or marking time, with the exception of gold mining, the international value of this metal being fixed. The cost of supplies and labour has decreased considerably, as compared with the previous three or four years, and as the value of gold has not changed, gold mining is now more prosperous than it had been for several years. Unfortunately the production of gold in the Province of Quebec is insignificant. In fact we have no gold industry proper, for the small quantity which we produce is a by-product from the treatment of other ores.

Practically all the substances which figure in the table of production have been deeply affected, and all but one small item show very notable decreases. From all present appearances the recovery will be gradual and slow, rather than spectacular, and many of the substances, the production of which had been stimulated by the war demands, may not reach their past maximum figure for many years to come. Several, such as chromite, magnesite, may never recover entirely.

That the industrial depression was world wide, and affected deeply the whole of the North American continent is reflected by the preliminary review of the mineral industries in the United States during the year 1921, as presented in the technical press of that country. The average price of copper quoted at New York for the year 1921 was 12.50 cents, as compared with 17.46 for the average of 1920. Lead was 4.70 cents for 1921, as compared with 8.00 cents in 1920. Zinc decreased to 4.76 cents per pound in 1921 from 8.10 cents in 1920. The shipments of iron ore from Lake Superior district show a falling off of 61% in tonnage, and the average price per ton for the year had decreased from $4.25 in 1920 to $3.50 in 1921.

Under such circumstances it is not to be wondered at that our production of metallic ores suffered so grievously.

In 1921, the metallic products of the Quebec mines figure in the table for less than $100,000., whereas in 1920 they represented $483,888 ; in 1919 they were valued at $1,014,088, and $2,855,-120, in 1918, which was the maximum obtained.

The non-metallics (exclusive of building materials) showed diminution from $15,771,852, in 1920, to $5,549,282 in 1921. Building materials suffered less, and decreased from $12,054,857, in 1920 to $9,888,811, in 1921. The decrease is due to falling off in quantity production and lower prices.

TABLE OF VALUE IN DOLLARS, OF THE ANNUAL MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC FROM 1900 TO 1921

YEAR	VALUE	YEAR	VALUE
1900.....$	2,546,076	1911.....$	8,679,786
1901.....	2,997,731	1912.....	11,187,110
1902.....	2,985,463	1913.....	13,119,811
1903.....	2,772,762	1914.....	11,732,783
1904.....	3,023,568	1915.....	11,765,873
1905.....	3,750,300	1916.....	13,287,024
1906.....	5,019,932	1917.....	16,189,179
1907.....	5,391,368	1918.....	18,707,762
1908.....	5,458,998	1919.....	20,813,670
1909.....	5,552,062	1920.....	28,392,939
1910.....	7,323,281	1921.....	15,522,988

The scarcity of labour which had prevailed throughout the year 1920, began to ease off considerably in the spring of 1921. The standard daily wage of common labour in the mines of Quebec and Ontario during the years 1918 to 1920 had been $4.25 to $5.00, but operators, owing to the falling off of the markets and the great decreases in the demand for the products of the mine, had to begin cutting down expenses and wages in the first quarter of the year 1921. In May, common labour was reduced to $3.25, and in the fall to $2.50 per day, of 10 hours. Moreover owing to greatly curtailed operations the unemployment problem became a grave question, and finally, many companies who had shut down altogether made an effort to reopen, at a sacrifice, so as to relieve the distress by employing as many men as they could on repairs and development work.

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1921

Substances	Number of workmen	Wages $	Quantities	Value in 1921 $	Value in 1920 $
Asbestos, tons....	2,753	3,041,199	84,475	5,199,789	14,749,048
Asbestic, tons....	.....	.....	12,397	14,536	43,559
Chromite, tons...	60	24,000	1,893	22,696	247,730
Copper and Sulphur ore, tons..	58	38,312	1,986	10,463	98,854
Dolomite, tons....	7	5,813	1,167	8,001	.....
Feldspar, tons....	65	39,766	9,797	79,752	11,252
Gold, oz.....	42	9,701	648	12,317	19,346
Graphite, lb.....	1	1,221	84,684	2,422	31,913
Kaolin and Fire clay, tons.....	25	21,699	158	1,987	16,681
Magnesite, tons..	161	89,345	4,984	74,110	512,753
Marl, tons.....	10	4,500	.....	.....	.....
Mica, lb.....	110	42,773	288,197	42,222	281,729
Mineral paints (iron oxide, ochre), tons...	44	46,246	8,894	90,765	136,098
Mineral water, gal.	6	2,019	14,621	5,339	9,962
Molybdenite, tons.	6	4,803	.....	.....	.....
Phosphate, tons..	.....	.....	30	453	.....
Quartz and silica rock, tons.....	48	23,098	6,496	29,906	60,147
Silver, oz.....	.....	.....	39,327	21,339	58,032
Talc, tons.....	.....	.....	.....	.....	1,050
Titaniferous iron ore, tons.....	.....	.....	.....	.....	2,999
Zinc and Lead ore, tons.....	92	49,841	15,500	18,080	56,927
Building Materials					
Brick, M.....	579	421,338	78,665	1,198,471	1,956,473
Cement, bbls.....	644	896,291	2,135,631	5,410,276	6,545,053
Granite.....	300	217,297	.....	369,122	494,372
Lime, tons.....	227	125,325	54,920	624,574	682,477
Limestone, tons...	1,047	905,713	1,007,733	1,523,027	1,584,316
Marble, tons.....	97	110,394	1,155	167,664	228,353
Sand, building, tons.....	100	64,872	596,673	263,813	206,433
Sandstone, tons.	3	1,713	295	2,328	21,910
Slate, tons.....	33	28,840	6,086	48,766	14,200
Tile, drain and sewer pipe, pottery, etc.....	98	84,085	.....	280,770	321,270
Totals.....	6,616	6,300,204		15,522,988	28,392,939

TARIFF LEGISLATION IN THE UNITED STATES

There is at present before the United States Senate, a bill called "The Tariff Act of 1921 (H. R. 7456)" "to provide revenue, to regulate commerce with foreign countries, to encourage the industries of the United States, and for other purposes, as passed by the House of Representatives on July 21st 1921, and referred to the Senate Committee on Finance on July 22nd 1921". This bill provides rates of duty on articles imported into the United States or any of its possessions. In March 1922 the measure was still under discussion.

The clauses which, if adopted in their original form, would affect some of our mineral products, are the following : —

Schedule 1, *paragraph* 47.—Magnesium ; carbonate, precipitated, 2½ cents per pound ; sulphate (Epsom salts) one half of one cent per pound ; oxide, medicinal, 7 cents per lb ; calcined magnesia, not medicinal, and calcined magnesite, including dead-burned and grain, three quarters of a cent per pound ; and magnesite, crude or ground, one half of one cent per pound.

Paragraph 60.—Phosphorus, 10 cents per lb.

Paragraph 64.—Barytes ore, crude or manufactured, $4.00 per ton ; ground or otherwise manufactured, $7.50 per ton ; precipitated barium sulphate or blanc fixe, 1 cent per lb.

Paragraph 70.—Ochers, siennas and umbers, crude or not ground, one fourth of one cent per lb ; washed or ground three eighths of one cent per lb ; iron oxide and iron-hydroxide pigments not specially provided for, 20 per centum, ad valorem.

Paragraph 74.—Zinc oxide and leaded zinc oxides, containing not more than 25 per centum of lead, in any form of dry powder, 1½ cents per pound.

Schedule 2.—*Paragraph* 201.—Magnesite brick, three-fourths of one cent per lb, and 10 per cent ad valorem ; chrome brick, not glazed, painted, enameled, vitrified or decorated, 20 per cent ad valorem.

Paragraph 202.—Tiles, unglazed, glazed, ornamented, enameled, vitrified, semi-vitrified, decorated, encaustic, ceramic, mosaic flint, spar, embossed, grooved and corrugated, and all other earthenware tiles and tiling, by whatever name known, except pill-tiles, and so called quarries, or quarry tiles, but including tiles wholly or in part of cement, valued at not more than 40 cents per square foot, 8 cents per square foot, but not less than 35 nor more than 50% per cent ad valorem.

Paragraph 203.—Roman, Portland and other hydraulic cements in barrels, sacks or other packages, 5c. per hundred pounds.

Paragraph 204.—Limestone (not suitable for use as building stone), crude, or crushed, but not pulverized, 5 cents per one hundred pounds; hydrated lime, 12 cents per one hundred pounds.

Paragraph 207.—Clays or earths unwrought or manufactured, including common blue clay, not specially provided for, $1. per ton; china clay or kaolin, $2.50 a ton; silica, crude, not specially provided for, $4. per ton.

Paragraph 208.—Mica unmanufactured, or rough trimmed only, 4 cents per lb and 17 per cent ad val.; mica, cut and trimmnufactures of mica, or of which mica is the component material of chief value, 10 cents per lb, and 17 cents ad valorem; ground ed, mica splittings, mica plates and built up mica, and all manica, 4 cents per lb; and 20 per cent ad valorem.

Paragraph 209.—Talc, steatite or soapstone, and French chalk, crude and unground, one fourth of one cent per lb.

Paragraph 211.—Graphite or plumbago, crude or refined, not specially provided for, 10 per centum ad valorem.

Paragraph 232.—Marble, breccia, onyx, in block, rough or squared only, 65 cents per cubic foot; sawed or dressed, over two inches in thickness, $1. per cubic foot; slabs and tiles of marble, breccia, onyx containing not less than four superficial inches, if not more than one inch in thickness, 8 cents per superficial foot;

1 in. to 1½ in. in thickness, 10 cents ; 1½ to 2 inches, 13 cents ; if rubbed in whole or in part, 3 cents in addition per superficial foot.

Paragraph 234.—Buhrstones, manufactured or bound up into millstones, 13 per centum ad valorem.

Paragraph 235.—Freestone, granite, sandstone, limestone, lava, and all other stone suitable for use as monumental or building stone, not specially provided for, hewn, dressed or polished, 40 per centum ad valorem ; unmanufactured, or not dressed, hewn or polished, 15 cents per cubic foot.

Paragraph 236.—Grindstone, finished or unfinished, $2. per ton.

Paragraph 237.—Slates, slate chimney pieces, mantles, slabs for tables, roofing slates and all manufactures of slates, not specially provided for, 17 per centum ad valorem.

Schedule 3.—*Par.* 302.—Manganese ore, or concentrates containing in excess of 30 per centum of metallic manganese, 1 cent per pound on the metallic manganese contained therein ; molybdenum ore or concentrate, 75 cents per lb on the metallic molybdenum contained therein ; ferro-molybdenum, and all other compounds and alloys of molybdenum, $1.25 per pound on the molybdenum contained, and 17 per cent ad valorem.

Paragraph 378.—Copper in rolls, rods or sheets, 2½ cents per pound.

Paragraph 388.—Lead-bearing ores and mattes of all kinds, 1½ cents per pound on the lead contained therein.

Paragraph 390.—Zinc bearing ore of all kinds containing less than 10 per centum of zinc shall be admitted free of duty ; containing 10 to 20 per cent, one half of one cent per pound of zinc contained therein ; 20 to 25 per cent, 1 cent per pound of zinc ; 25 per cent or more, 1½ cent per pound of zinc contained therein.

MINERAL POSSIBILITIES OF QUEBEC

In the presidential address delivered at the annual meeting of the Canadian Institute of Mining and Metallurgy, held in March 1922, the President, Dr. C. V. Corless, reviewed in a masterly presentment, the Mining Industry in the future industrial development of Canada, and the following extracts are of great interest regarding the mineral possibilities of the province of Quebec.

"Let us review a few facts, well known to most members of this Institute, but probably not so well-known to the average well informed man whom we meet,—facts bearing on Canada's future place as a producer of minerals. We all are pleased with the progress of Mining in this country, in the past quarter of a century ; yet, compared with its certain future, the mining industry in Canada is scarcely in its infancy. Let us briefly summarize the principal facts and inferences substantiating this statement.

"For almost two decades, a former President of this Institute, Dr. Willet G. Miller, has been calling attention to the importance of Canada's enormous pre-Cambrian area, nearly surrounding Hudson Bay, occupying more than half of the entire surface of our country, the greatest single exposure (greater indeed than all others in the world added together), of our mother earth's basement, wherein, as we are recently finding, her richest treasures are stored for future use. Dr. Miller has not been alone in this, but he perhaps more than any other has given his ability, his voice and pen, without stint and, in his position, as Provincial Geologist of Ontario, has directed the work of a brilliant group of geologists, who have greatly assisted the mine operators and prospectors and who, incidentally, have demonstrated the soundness of his views, with regard to a small part of this enormous Archean area. Dr Wallace has for a shorter period performed a similar service in Manitoba.

"Now Canada, as is well known, has a monopoly of this huge area, excepting only a small spur into New York State and a

slight projection southwest of Lake Superior, into Michigan, Wisconsin and Minnesota. This projection, though only two or three per cent of the whole pre-Cambrian area, is beyond doubt one of the richest mining district in the world. It contains the famous Lake Superior iron mines, which produce annually more than eighty per cent of the entire output of iron ore in the United States ; which have still almost inexhaustible reserves of ore remaining ; and which, more than any other single factor, have made that country pre-eminent in iron and steel production. It contains also the famous copper deposits of Keweenaw Peninsula in Michigan, which have been worked for three quarters of a century ; which have for years, if we except the present period of depression, produced more than two hundred million pounds of copper annually ; and which have still as reserves very great but unknown tonnages of copper ore.

"On the Canadian side of Lake Superior, real prospecting in this vast pre-Cambrian area is scarcely begun. The Bruce Copper mines were easily discovered many years ago, since they were along the shore of Lake Huron. The story of the accidental discovery of nickel ore in the Sudbury district thirty-seven years ago is well known. Though surface prospecting soon located most of the outcrops, some of the principal orebodies, and the enormous importance of the three nickel-copper deposits of this district as a whole, have been demonstrated only by extensive and costly exploration with the diamond drill, chiefly within the past ten or twelve years. The first discovery at Cobalt, during the railway construction, was as accidental as that at Sudbury. Porcupine, one mine in which may soon reach the position of the world's greatest gold producer, is not far from the same railway. Each of these three camps, Sudbury, Cobalt and Porcupine—, will, during its total life, produce metals of a gross value amounting to hundreds of millions of dollars. Each of these camps has acted as a stimulus to prospecting. Prospectors generally experienced in them, have found a large number of other nickel, silver, and gold-bearing areas, of which some are already reaching steady production ; some are being developed only ; and others of considerable promise are not yet beyond the stage

of preliminary exploration ; but all, when considered together, contribute to the impression, which, for those giving the subject close attention, has grown to be a certainty, that these metals, and probably others as well, are very widely and generously distributed.

"There have also been found extensive iron ore areas, which require much more detailed exploration than they have yet received. The deposits of iron ore so far discovered present slight, but certainly not insuperable, technical difficulties. Their chief present handicap is competition with the richer and more easily mined Lake Superior ores already mentioned. In this great pre-Cambrian area in Canada, there are already known a number of areas of similar geological age and formation to those associated with the Lake Superior iron ore deposits and undoubtedly others will be found. It is only reasonable to expect that continued geological work, followed by detailed prospecting and exploration, will yet find large and rich iron ore deposits, requiring no concentration, and suitable in composition for steel-making. Probably one or more of these will be found near the shores of Hudson Bay, on both sides of which Keewatin and Huronian areas, similar to those associated with the Lake Superior iron ores, are known. This large inland sea is said to be navigable for about as great a part of the year as Lake Superior. The fact of our great national need is an added stimulus in the search for accessible bodies of iron ore of higher grade than those already found; and in our attack on the technical problems arising from our already known deposits of iron ore.

"Quebec has far the largest share of the great pre-Cambrian shield, which fills ninety per cent, if not more, of the entire province. Cobalt, Porcupine, and some of the newer discoveries already referred to, are near the Quebec boundary. Geological formation and ore deposition bear no relation to interprovincial boundaries established by man. But Quebec has not yet seriously turned her attention to the exploration and geological mapping, much less to the prospecting, of this huge area. The attention of her mining men has so far been largely directed to the

rich mineral deposits of the Acadian Highland, which occupies the Eastern townships and Gaspé Peninsula, and in which asbestos, chrome, copper, lead, zinc and gold ores, as well as other valuable minerals, have been found. There is no reason to doubt that enormous treasures in minerals in this area await discovery by the thrifty people of this province, whose well known pioneering ability, which has been so successful with the axe and the canoe, will prove to be equally successful when their keen natural aptitude is specially trained and turned to the search for minerals in this great northland of their province.

"We can after these glimpses, will afford to stand off for a few moments in order to try to estimate even more broadly the probable significance to mining of this enormous region surrounding Hudson Bay, with an area of 2,000,000 squares miles, occupying considerably over one-half the entire surface of Canada.

"A little is known of the general geology and ore deposits of scattered areas, totalling not more than ten per cent of it, and in this smaller area the detailed geology has been worked out over only a few hundred square miles, near important discoveries. But beyond this small fraction only a few intrepid explorers have crossed the Archean area here and there, following the lakes and streams. These agree that the general age and formation of the rocks revealed along these routes of exploration are similar to those already examined in greater detail. But beyond these broad statements not even general outlines of the geology of most of this vast territory have been accurately worked out. Fortunately, enough is known to make reasonably certain that the broad average formations of the less known parts will closely resemble those of the parts already more fully examined. In the only parts where any detailed geological examination and prospecting have been carried out, there have already been discovered the fabulously rich deposits of iron, copper, nickel, gold and silver, already alluded to, containing many thousands of millions (billions) of dollars in gross value of these metals.

"The partly geologized and prospected area of the great Laurentian shield as outlined is on so large a scale relatively to the

whole, and the area of the whole is so vast ; also—, the similarity of formation, as far as observed, of the wholly unprospected area to the partly prospected area is so marked ; as reasonably to preclude the element of chance and to leave the conclusion almost irresistible, that, if geological work and prospecting in detail are persistently and intelligently followed up, results broadly similar to those referred to will repeatedly be obtained in the vast, almost entirely unexplored, and wholly unprospected, areas of this great pre-Cambrian region. And not only this ; but continual discoveries in the partly prospected region are convincing evidence that even in this restricted area a mere fraction of the valuable metalliferous deposits has so far been discovered. Only rough prospecting has so far been carried out over a part of this smaller area. Scientific prospecting is not really begun. In this area, very great possibilities undoubtedly await the future application of science to detailed prospecting, such as is now well begun in Sweden and Finland. In fact, I know of no field of greater promise for the applied scientist than that of prospecting.

"Over a large part of this mining area, lumbering will for many years be an important industry, and over some of it reforestation may make lumbering a permanent industry. But exclusive of this factor, which, so far, has made all too little progress, we shall find that as the lumberman succeeds the trapper, so, speaking broadly, will the prospector and the miner succeed the woodsman.

"The miner is not limited by climate as is the agriculturist. Wherever the climate of any region is not so severe as to leave it under a perpetual mantle of snow and ice ; and wherever, because of glaciation, geological formation, or ordinary erosion, there is reasonable rock exposure, there men will persist in seeking mineral treasures. Even where these rock exposures do not frequently occur, but where stratification and folding can be worked out so as to lead to reasonable suspicion of hidden mineral, such as gas, oil, salt, sulphur, or coal, there will men of enterprise risk their money in exploring with the drill."

CHEMICAL LABORATORY

The Quebec Bureau of Mines maintains at the Polytechnic School, of the University of Montreal, 228 St. Denis Street, an up-to-date, well equipped laboratory, for the convenience of the interested public. Analyses and assays, determinations of minerals and tests of various ore, samples, and materials found within the boundaries of the Province of Quebec, are made in this laboratory at prices which are extremely low for the high-grade work done. The laboratory has been established for the sole purpose of aiding the development of the mineral resources of the Province of Quebec. Prospectors and all persons interested in the Quebec mineral resources are cordially invited to avail themselves of the facilities offered. The tariff in force for the analysis and assay of various substances is given further on, and it will be realized that the fees are very low as the high competence of the chemists ensure results of undoubted reliability.

During the year ending December 31st, 1921, the Provincial Laboratory effected 1228 analyses, assays and tests as follows :—

Aluminium 16 ; ash 6 ; barium 1 ; cadmium 1 ; carbon, graphitic 1 ; carbon, fixed 8 ; chrome 1 ; combustion 10 ; copper 41 ; gold 448 ; graphite 1 ; iron 33 ; lead 9 ; lime 18 ; magnesia 15 ; moisture 6 ; molybdenum 1 ; nickel 7 ; organic matter 1 ; phosphorus 10 ; platinum 7 ; potash 6 ; calorific power 11 ; silica 24 ; silver 443 ; sulphur 14 ; tin 2 ; tungsten 1 ; volatile matter 6 ; zinc 5 ; qualitative tests 75.

Province of Quebec

GOVERNMENT ASSAY LABORATORY

(Under the direction of the Bureau of Mines of the Province of Quebec as an aid to the development of the mineral resources.)

TARIFF OF FEES FOR ASSAYS AND ANALYSES

DETERMINATIONS	Less than 5 samples Each.	For 5 Samples or more Each.
	$ Cts.	$ Cts.
Moisture	0.25	0.25
Combined Water	0.50	0.50
Gold and Silver	1.00	0.90
Silica, Copper, Iron — 1 constituent	1.00	0.90
Silica, Copper, Iron — 2 constituents in same sample	1.75	1.50
Iron, in titaniferous ore	2.00	1.80
Alumina, Cobalt, Graphite, Lead, Lime, Magnesia, Nickel, Sulphur — 1 constituent	1.50	1.25
Alumina, Cobalt, Graphite, Lead, Lime, Magnesia, Nickel, Sulphur — 2 constituents in same sample	2.50	2.25
Antimony, Arsenic, Bismuth, Chromium, Manganese, Molybdenum, Phosphorus, Platinum, Titanium, Zinc — 1 constituent	2.00	1.80
Antimony, Arsenic, Bismuth, Chromium, Manganese, Molybdenum, Phosphorus, Platinum, Titanium, Zinc — 2 constituents in same sample	3.50	3.15
Commercial analysis of an iron ore, comprising determination of silica, iron, phosphorus, titanium and sulphur	6.50	5.85
Commercial analysis of a limestone or cement, comprising silica, lime, iron, alumina, magnesia, and sulphuric acid	6.00	5.40
Commercial analysis (proximate analysis) of a fuel, comprising : ash, volatile combustible, fixed carbon, moisture	3.00	2.70
Calorific power of a fuel	1.50	1.35
Radioactivity of a mineral	1.00	0.90
Radioactivity of a mineral water	2.00	1.80

DETERMINATIONS OF MINERALS.—For a nominal fee of 25c. for each sample, the laboratory will make determinations of ores and minerals, provided rapid tests will allow it, and issue a report on probable contents and commercial value of specimens and samples.

TERMS.—Money in payment of fees, by registered letter, postal notes or orders, must invariably accompany the samples, in order to insure prompt return of certificate.

Professor AD. MAILHIOT.
In charge of Laboratory

No. 228 St. Denis St., Montreal.

MINING OPERATIONS

ASBESTOS

The year 1921 was a poor one for the asbestos industry. The quantity of fibre shipped is the lowest recorded since 1910, and in value it is the lowest since 1916. In contrast, the stocks on hand at the end of the year had never been so high, an index of the sluggishness of the demand.

The returns of the asbestos operators for the year 1921, show that the shipments of fibre amounted to 87,475 tons, valued at $5,199,789, as compared with 179,891 tons valued at $14,749,048 during the year 1920. We therefore have to record a decrease of 51.3% in tonnage and of 64.7% in value. In fact we have to turn back to the year 1910 for as low shipments in quantity, for which year the figures were 80,605 tons, and to 1916 for as low figures in value which in that year amounted to $5,182,905.

At the end of the year 1921, the stocks on hand, stored in the mill sheds amounted to 53,345 tons, which if valued at the same prices as the fibre sold and shipped, represented a value of $6,764,598. It is doubtful if this price will be realized as it is probable that owing to the sluggishness of the demand, a substantial proportion of the estimated value will have to be written off. Both in quantity and value, the stocks on hand on December 31st 1921 constitute record figures.

The average value of the asbestos shipped during the year was $59.44 per ton, as compared with $81.99 in 1920. The great difference in this average price is ascribable to two causes. There was a decrease in the prices of all grades of asbestos, but the main reason was that what demand there was for asbestos, was mainly for the lower grades, whereas for the three previous years the contrary was the rule. A glance at the table of production for 1921 shows that at the end of the year the stocks on hand of crude No 1, crude No 2 and spinning fibre were greater than the shipments of these grades during the whole year, whereas, for shingle fibre and paper stocks a greater quantity

had been shipped than remained in the sheds. As a result the average value of the asbestos stocks, in storage at the mills, was $125.47 a ton, as compared with $59.44 for the asbestos disposed of during the year.

In spite of the adverse industrial and market conditions, the mining operations were kept up fairly actively during the greater part of the year, as shown by the quantity of rock mined which amounted to 2,224,138 tons, as compared with 3,123,370 tons for the previous year which had been the highest on record. The decrease in rock mined was therefore slightly under 30%. This is greatly to the credit of the operators who, as a general rule, did their utmost to keep the mines and mills going, at the cost of considerable sacrifice, and operations were curtailed only when it became unavoidable. And even then a considerable number of men were kept, on repair and alteration work, as a measure of relief to the situation of unemployment which became rather acute towards the end of the year.

The quantity of rock mined and hoisted during 1921 was 2,224,138 tons from which was extracted 117,458 tons of fibre, valued, at the prices prevailing during the year, at $9,532,039. This of course takes into account the stocks on hand at the end of 1920 and of 1921.

Therefore the average content in asbestos of the rock mined in 1921, was 107.2 lb, valued at $4.28.

The detail of the production of asbestos during the years 1920 and 1921 is given in the following table : —

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1921

DESIGNATION OF GRADE	Shipments and Sales: Tons	Shipments and Sales: Value	Average Value per ton	Stock on hand Dec. 31st, 1921: Tons	Stock on hand Dec. 31st, 1921: Value
Crude No. 1	184	$ 234,482	$1,281.32	857	$ 965,837
Crude No. 2	760	339,649	446.91	2,475	1,710,163
Spinning Fibre	5,372	1,413,318	263.09	7,646	2,124,801
Shingle Fibre	9,650	981,872	101.75	5,324	524,490
Paper Stocks and others	71,509	2,230,468	31.19	37,043	1,439,307
Totals	84,475	$5,199,789	$ 59.44	53,345	6,764,598
Asbestic	12,397	$ 14,536	$ 1.17	3	4
Totals	99,872	$5,214,325		53,348	6,764,702

Quantity of rock mined during the year :— 2,224,138 tons,

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1920

DESIGNATION OF GRADE	Shipments and Sales: Tons	Shipments and Sales: Value	Average Value per ton	Stock on hand Dec. 31st, 1920: Tons	Stock on hand Dec. 31st, 1920: Value
Crude No. 1	1,026	$1,513,439	$1,475.08	446	$ 659,259
Crude No. 2	2,830	2,296,302	811.41	854	829,438
Spinning Fibre	14,068	3,933,918	279.63	1,929	653,115
Shingle Fibre	16,784	1,852,210	110.35	1,306	172,476
Paper Stocks and others	145,189	5,153,179	35.49	18,826	118,050
Totals	179,891	$14,749,048	81.99	23,561	2,432,348
Asbestic	19,716	43,559	2.20	125	274
Totals	199,607	$14,792,607	.....	23,486	$2,432,622

Quantity of rock mined during the year : — 3,123,370 tons.

The following table, gives in condensed form, the general data of the Asbestos industry in the Province of Quebec since 1911, and illustrates its progress.

TABLE OF DATA OF THE QUEBEC ASBESTOS INDUSTRY FOR THE YEARS 1911---1921

YEAR	Fibre Shipped Tons	Total value $	Average value per ton $	Rock mined tons	Asb. content per ton of rock — lb.	Average value of content of rock $
1911.....	102,224	3,026,306	29.60	1,583,076	107.80	1.53
1912.....	111,175	3,059,084	27.52	1,870,603	108.6	1.38
1913.....	136,609	3,830,504	28.04	2,527,410	105.4	1.45
1914.....	107,401	2,895,935	26.96	2,127,395	111.4	1.43
1915.....	113,115	3,544,362	31.33	2,134,074	96.9	1.46
1916.....	133,339	5,182,905	38.87	2,291,087	102.6	2 12
1917.....	137,242	7,198,558	52.45	2,634,410	108.7	3.03
1918.....	142,375	9,019,899	63.35	2,445,745	117.3	4.08
1919.....	135,562	10,932,289	80.47	3,061,620	100.8	3.88
1920.....	170,891	14,719,048	81.99	3,123,370	109.1	4.53
1921.....	87,475	5,199,789	59.14	2,224,138	107.2	4.28

EXPORTS OF UNMANUFACTURED CANADIAN ASBESTOS FOR 12 MONTHS ENDING DECEMBER 31ST 1921.—

(*Reports of "Trade of Canada"*)

	Tons	*Value*
United Kingdom.....	4,564.....	$ 513,878
United States.....	65,128.....	3,087,986
Australia.....	175.....	21,438
Belgium.....	3,524.....	418,518
France.....	1,932.....	348,504
Germany.....	3,437.....	493,024
Italy.....	230.....	32,100
Japan.....	1,842.....	158,430
Netherlands.....	3,923.....	560,873
Other countries.....	639.....	55,521
Total.....	85,394	$5,690,272

According to a tabulation of figures of importations of raw asbestos into the United States during the year 1921, compiled by the publication "Asbestos" from United States official reports the total raw asbestos imported into that country during the year was 64,700 tons valued at $2,949,662, as follows : —

	Tons	*Value*
British South Africa	449	$ 72,980
Portuguese Africa	240	96,250
Italy	2	800
England	179	73,264
Japan	1	1,239
Australia	1	371
China	48	5,414
Chile	—	212
Germany	10	10,253
Trinidad & Tobago	1	80
	940	260,863
Canada	63,760	2,688,799
Total	64,700	$ 2,949,662

An analysis of the above figures is interesting. The imports into the United States appearing as coming from British South Africa, Portuguese Africa and England, are probably all ascribable to the production of Rhodesia, Transvaal and Cape Province, shipped from the ports of Beira and Lorenzo Marques in Portuguese South Africa, and from Port Elizabeth and Cape Town in Cape of Good Hope Province. These figures are therefore 877 tons valued at $242,494, representing chrysotile asbestos from Rhodesia, crocidolite or blue asbestos from the Cape, and amosite, or long fibre hornblende asbestos from the Transvaal. As compared with the imports from Canada (taking the U. S. figures which are appreciably less than the Canadian export figures) the importation of South African Asbestos into the U. S. would therefore be 1½% in quantity and 9% in value, showing that only long fibre South African asbestos is imported.

Asbestos Mining in 1921.—Returns of shipments of asbestos were received from 16 companies, who operated 22 mines during the year 1921 : —

Asbestos Corporation of Canada, Ltd, Thetford Mines, P. Q.
Asbestos Mines, Limited, East Broughton, P. Q.
Bell Asbestos Mines, Thetford Mines, P. Q.
Bennett-Martin Asbestos & Chrome Mines, Ltd, Thetford Mines, P. Q.
Black Lake Asbestos & Chrome Co, Ltd, Black Lake, P. Q.
Canada Asbestos & Chrome Co, Coleraine, P. Q.
Canadian Johns-Manville Co. Ltd, Asbestos, P. Q.
Consolidated Asbestos Ltd, Thetford Mines, P. Q.
Federal Asbestos Co, Robertsonville, P. Q.
General Asbestos Co, East Broughton, P. Q.
Guillemette D., Thetford Mines, P. Q.
Johnsons' Company, Thetford Mines, P. Q.
Maple Leaf Asbestos Corporation, Ltd, Thetford Mines, P.Q.
Pennington Asbestos Company, Thetford Mines, P. Q.
Quebec Asbestos Corporation, East Broughton, P. Q.
Windsor Asbestos Co. Ltd, Coleraine, P. Q.

It may also be mentioned that apart from the operations by the above companies, prospecting and development work was also carried on in the townships of Coleraine, Bolton, Talon, Cleveland, Garthby, Ham, and Kilkenny, on asbestos showings, some of which may eventually prove of workable size.

Asbestos Corporation of Canada, Ltd, owners of four well equipped asbestos mines, restricted their operations to three of these, the fourth the Fraser mine at East Broughton, having closed down at the beginning of winter in 1920, was not reopened in 1921.

The Asbestos Corporation is the largest producing company of asbestos in the world. Operations during 1921 were carried on at the King mine (lot 26, ranges V and VI, Thetford), at the Beaver mine (lots 31 and 32, range C, Coleraine) and at the British Canadian mine (Black Lake, Coleraine township). The

fourth mine, the Fraser, (lot 14, range VII Broughton) remained idle the whole year.

At the King mine the pit has not been greatly deepened since the publication of our report for 1920, when it was somewhat over 300 feet, but it has been widened, more especially towards the east end. The five large hoisting derricks have been in commission all year, and in November a sixth was under construction,—which will notably increase the hoisting capacity. These cable-derricks, especially designed for the Asbestos Corporation of Canada, have been described in our previous reports. They hoist the ore from the bottom of the pit in large steel boxes, containing six tons of rock. The working capacity of each cable-derrick is 350 tons of rock per shift of 10 hours.

A great deal of work was done towards removing the surface covering, as indicated in our last report, to permit of extending the operations of the present pit towards the north. Some of the overburden was removed by hydraulicking, but some difficulty was encountered in the form of an unexpectedly large number of boulders, which, mixed with the tough blue clay interfered greatly with the operations. The reinforced wooden pipe, 20″ in diameter and 3000 feet long, through which the desintegrated material was discharged on the dump beyond the Thetford river could not stand the wear and tear due to abrasion. It soon had to be replaced by a steel riveted pipe, and eventually this had to give place to a cast iron pipe. The progress was not as rapid as anticipated, but new dispositions were taken during the winter, so as to resume activity in the spring of 1922.

The Beaver mine, was operated during the whole year, but at a reduced rate of activity. During the last months the mine worked only four days a week, and this was mainly as a measure of relief to alleviate the unemployment situation. There have been no radical changes in the methods, or the scope of mining and milling at the Beaver mine for three of four years.

The British-Canadian mine, at Black Lake, completed the

development work and the mill construction and improvements outlined in our report of last year. The British Canadian mine, as now designated, consists of the merging of the workings of the old British-Canadian properties, the Dominion mine and the Standard mine, these three properties having been acquired in 1909 by the Amalgamated Asbestos Corporation, which was reorganized in 1912 as the Asbestos Corporation of Canada. The British-Canadian Asbestos Co, former owners of the British-Canadian mine, had been organized in 1908 to take over the properties of the American Asbestos Co, which consisted of lot 32 range B, part of lot 32 range A, The Glasgow and Montreal Co's lot, in block A, and the Manhattan Asbestos Co's lot, also in block A, all in Coleraine township, as well as lots 28 range VI, and 26 range VII Ireland. The Standard mine adjoining the Manhattan, was the property of the Standard Asbestos Company, and it had been opened up by the Anglo Canadian Asbestos Co. The mining lands of the Standard Company comprised an area of 325 acres in block A of Coleraine. In 1906 the North East part of the Standard property was acquired by a new company — the Dominion Asbestos Company, which opened up a new quarry, the Dominion mine.

At the *Bell mine,* the new inclined tunnel has been successfully completed. The section is 12 feet by 13 feet, and it is 1035 feet long, on a grade of 10%. Owing to very bad moving ground encountered about 300 feet from the surface portal of the tunnel serious difficulties had to be overcome. The upper 500 feet had to be lined with a thick wall of concrete, and in the roof fifty pound rails were a laid horizontally. In the walls, stout timbers 8″ x 10″, spaced 16 inches center to center have been embedded in the concrete. Safety recesses, in which four men can take shelter from mine cars, have been left in the walls of the tunnels at regular distances apart.

A new crushing plant is being built on the surface, and a 5000 ton rock-storage bin. The crusher building is 120 feet by 88 feet wide, and will house two jaw-crushers with opening 36″ by 24″, two dryers, and four No 3 gyratory crushers. During

the summer a new storage shed 400 by 48 feet has also been erected.

The Bennett-Martin Asbestos & Chrome Mines operate two mines, one at Thetford, lots 27 and 28 range V, and another called the Vimy Ridge mine, at Coleraine, on lots 23, 24 and 25 of range III of Ireland township.

The Thetford mine was practically idle during the whole of 1921, operations being restricted to getting out a comparatively small quantity of crude fibre.

At the Vimy Ridge mine the railway spur from Coleraine to the mine, six miles long, was completed. Mining operations were curtailed owing to the sluggishness of the market, but towards the end of the year more activity was apparent, and in December, work in two shifts was resumed.

In our last report it was mentioned that a new milling practice was tried, by replacing the cyclones by gyratory crushers as much as possible. After a thorough trial it was decided that the gyratories were not as satisfactory as the cyclones, and the mill for the present, has reverted to the old practice.

Towards the end of the year the demand was for paper stocks almost exclusively, and the longer fibre grades were very difficult to dispose of.

The Martin-Bennett carried on development work on a very promising occurrence of asbestos-bearing area on lot 28, range IV of the township of Ireland, situated about 1½ miles South-East of the Vimy Ridge mine, and a quarter of a mile from the shore of Black lake.

This property was opened in the latter part of 1920. The work done up to date consists of one main open cut, 100 feet long, by 10 feet wide, equipped with a cable-derrick 200 feet long, steam hoist and boiler, and of numerous small test pits. The following buildings have been erected : — compressor building, housing one 9 x 9 x 8 direct line compressor, 200 cubic feet free air ; one 20 H.P. locomotive boiler ; one air receiver ; der-

rick-hoist building ; cobbing shed ; powder magazine ; camp building ; stable.

A considerable area of timber land was cleared for fire protection. The elevation of the main open cut is 1500 feet above the elevation of Black Lake. This open cut exhibits a rich body of mill rock, with a considerable proportion of crude. The rock is more fractured and more highly serpentinized than the adjacent zone at Vimy Ridge. The crude and the fibre are white, silky and as far as could be judged equal to the Thetford quality.

During 1921 a very appreciable quantity of crude fibre was extracted and cobbed, in the course of opening the workings. Work was carried on all summer, until late in the fall, when the camp was closed down for the winter.

The Consolidated Asbestos, Ltd, worked their Thetford mine (formerly the Jacobs mine) full time during the first three months of the year. During the second quarter, operations were reduced and during the last five or six months practically no mining was done, but as many men as could be taken care of were employed on repair and alteration work both in the mine and in the mill.

The Black Lake Asbestos and Chrome Co, worked all year without much interruption, and they also did much development and improvement work. At the Union mine, No 9 pit, a tunnel of a section 14 ft. x 19 ft. was driven 106 feet to a point under the bottom of No 6 pit, and the rock from the latter pit is now worked by glory holing, and is hauled by the tunnel through No 9 pit.

An important development has been the reopening of the Southwark quarry to the north east of No 9 pit. After considerable core drilling to a depth of 125 feet from the floor of this quarry, some very promising rock was blocked out, justifying the erection of two large cable-derricks, with a span of 1250 feet between towers. The Southwark quarry is designated as Pit No 1.

The Canada Asbestos and Chrome Co. Ltd, who in 1920 had

done considerable prospecting on the old "Greenshield lot", a strip of land inclosed in Block B of Coleraine township, carried on development work in 1921 and built a mill. The mine and mill are on the road from Coleraine station to Vimy Ridge mine. The mill buildings consist of a crusher and dryer house, 26 feet by 58, containing three jaw crushers and a rotary dryer. The dry rock is then taken by a belt conveyor, running in a covered passage, to the top of the second building and passed through jumbos, shaking screens and graders mostly by gravity. The mill was operated for some months during 1921, but closed down in the latter part of October.

The Maple Leaf Asbestos Corporation, Ltd, who control lots 27, 28 and 29, range A of Coleraine, completed the installation of the new mill and this was started in March 1921. The quarry now measures 300 feet by 180 feet and is 84 feet deep. The capacity of the mill is 350 tons per two shifts of 10 hours each.

In the East Broughton district, the *Quebec Asbestos Corporation* carried on its operations without interruption during the whole year, in both No 1 pit, the old workings; and in No 2 pit, formerly worked by the Asbestos Fibre Mining Co, an adjacent property which they acquired in December 1920.

The steam shovel which was used for loading the rock into the mine cars, has been replaced by a Harris excavator on caterpillar wheels. This does away with the necessity of tracks, and it is giving satisfaction.

The compressor house, erected some two years ago was burnt down in May 1921, as well as part of the head frame erected over the vertical shaft which had been sunk for prospecting and development. This was rebuilt without delay, most of the machinery having been salvaged and repaired.

From the bottom of the pit, to the west of the crusher, an incline was driven 117 feet under an angle of 50°, following the dip of the sheet of serpentine. From the bottom of the incline drifting was carried on towards the east and towards

the west. From the end of the western drift an inclined raise was driven to the floor of the pit, which it strikes at the lowest place, and these workings will serve as a sump into which the whole drainage of the quarry will flow, and pumps will be set up to raise the water to the surface.

The Pennington Asbestos Co, at Robertson, worked practically the whole year. There were some interruptions of a week or two, and operations, on the whole were not as active as during the previous year.

The Canadian Johns-Manville Co, at Asbestos, had planned out extensions and new constructions for the year 1921, but owing to the industrial depression the execution of these plans has been delayed. It was intended to complete the erection of the new mill (No 4 B), and to proceed with the construction of a factory for turning out finished asbestos articles, such as asbestos shingles, asbestos-asphalt paper, brake-bands and other products. The plans for this factory were completed, and are all ready, but actual construction was not started.

Asbestos Mines, Limited, with mine and mill at East Broughton, carried out a great deal of development and improvement work both at the mine and in the quarry. The mill, formerly of the Boston Asbestos Company, has been completely remodeled and modernized. Two "jumbos" are used as fiberizers, instead of cyclones. Each jumbo has a capacity of 15 tons of rock per hour. The mine is on lot 13*c*, of range IV of Broughton, 4000 feet from the mill, which is erected on lot 13 range V. The rock is brought to the mill by an aerial tramway, which was completed and put in operation in June. The installation comprises two ore-bins, one at the mine, of a capacity of 500 tons and the second at the mill of 1000 tons. Distance between bins 4250 feet, and the line of the tramway is straight. The carrying cable is 1⅛ inch, and the return cable for empty buckets is ⅞ of an inch. The buckets hold 1200 lbs of rock each. The fall between the loading platform and the receiving bin at the mill is 90 feet, which permits the load to travel practically by gravity.

The rock has a high content in fibre, which is of very good quality. Some difficulty has been experienced in very cold weather, owing to freezing of the dump rock in the bins, and in the buckets. This can be remedied by erecting a dryer at the mine to treat the crushed rock, before sending it to the loading bin.

Queen Asbestos, Limited, was organized to develop a promising asbestos prospect on lot 9, range IX of Cleveland, some two miles south of St. Cyr station. The work done during the year has consisted in surface trenching, and in an excavation some 60 feet long, 20 feet wide and 20 feet deep at the lowest point. There is a zone of asbestos-bearing rock, with parallel veins up to one inch in width. On the whole the appearance of the property is favourable and would justify some active prospecting and development work. The equipment at present is elementary, consisting of a steam boiler, a boom-derrick, a small steam hoist and a steam drill.

During the early part of the year some prospecting work was done by *Mr. Blumenthal* and associates, of Montreal, on an occurrence of pre-Cambrian asbestos on lot 10, range VIII of the township of Kilkenny, county of Montcalm. This occurrence was visited in July, by an officer of the Quebec Bureau of Mines.

On this lot, the property of Mr. Napoléon Régimbal, is a belt of crystalline magnesian limestone, striking N 30° to 40° E., between outcrops of typical Laurentian gneisses. The belt, where measured, appears to be 175 to 200 feet wide. At one third distance, from the north-west wall, the magnesian limestone is altered to serpentine, which varies in colour from light green to light brown, a large proportion of it being waxy in luster.

An excavation some 30 feet wide, and 20 to 30 feet into the slope of rising ground, with a shallow pit at the bottom of the opening, shows stringers of asbestos. A stripping to the south of the excavation shows one vein of asbestos, 2 inches wide, made up of several layers of short cross-fibre.

On lot 10, range VII, held under mining license by Messrs. Pagé and Boisvert, of St. Calixte, some work has been done, on the continuation of the limestone belt. An excavation 25 to 30 feet long, across the belt, and distant about 600 feet from the workings on the Regimbal lot, shows the rock to be all serpentinized, but no asbestos was observed. Considering the history of the work done in the past on occurrences of Laurentian asbestos in Quebec, and the disappointments which they have caused, without one exception, the Kilkenny deposit does not seem to offer many chances of developing into a workable occurrence.

Considerable prospecting was carried on for asbestos in the townships of Standon and Cranbourne, in an area of basic igneous rock which occupies the central part of Standon and the North corner of Cranbourne and comprises Cranbourne mountain. This area of igneous rocks, according to Ells' geological map is an elongated batholith, 15 miles long and 4 miles wide in the central part, which rises from the north west bank of the Etchemin river, and the longer axis of which is parallel to the river. This forms a link of the so called Serpentine Belt. The parts prospected comprised lots 24 to 28 of ranges I to VI, Standon, and lots 23 to 44 of range V of Cranbourne. Interesting discoveries are said to have been made during the summer of 1921, and exploration and prospecting will be actively carried on during 1922.

Standards of Gradings.—In our report for 1920, a description of the standard testing machine used for determining the grades of asbestos, was given in detail, and since then, according to the October number of "Asbestos", a review published in Philadelphia, the Asbestos Mine Operators Association of the Province of Quebec, at a meeting held in September, adopted the following standards for grading mill-fibres.

No 1—Mill Fibre (spinning)...Test.....	4	—7	—4	—1
No 2— " " " ... "	0	—8	—6	—2
		(½ oz on 1st screen)		
No 1—Shingle stock.....	0	—2	—10	—4
No 2— " "	0	—1½	—9½	—5

No 1—Paper stock.....0 —0 —9 —7
(½ oz on 2nd screen)
No 2— " ".....0 —0 —10 —6

While these grades are standards, the requirements of manufacturers may vary, and some orders may be on specifications deviating considerably from the above figures. The following article reproduced from the Engineering and Mining Journal, gives a very clear exposé of the requirements of manufacturers of asbestos goods at the beginning of the year 1922.

As explained in our last year's report, the figures of the tests represent the proportion in ounces, of the various lengths of fibre in a one pound sample of the asbestos being tested. The grade 4—7—4—1 for instance, means that in a 16 ounce sample of asbestos, there are four ounces of fibre longer than ½ inch ; 7 ounces passing through ½ inch screen and remaining on a 4 mesh screen ; 4 ounces passing through a four mesh screen and remaining on a ten mesh screen, and one ounce passing through a ten mesh screen.

(*) " The principal grades of asbestos are No 1 Crude, No 2 Crude, long spinning fibre, medium spinning fibre, magnesia and compressed sheet fibre, shingle stock, paper stock, cement stock, and floats, which are the grades used in our market quotations. Crude No 1 is asbestos greater than one half inch in length. It should be silky and of sufficient tensile strength to permit its use for making asbestos yarn, tape cloth, carded fiber, and other asbestos textiles. Owing to the different characteristics of asbestos produced by the several centers in Quebec, a variation will exist among the grades ordinarily sold in this class.

" Crude No 2 asbestos is generally referred to as mineral that has not been milled and which is less than ½ in. long. It must be of good tensile strength. Frequently it is mixed with Crude No 1 in the manufacture of asbestos textiles. Color is also a consideration in determining the price at which it can be

(*) Engineering and Mining Journal, March 25th 1922.

sold. Although some companies produce what they term a No 3 Crude, this classification is not generally recognized by the trade as standard.

"Long spinning fibre used in asbestos textile manufacturing tests anywhere from 4—7—4—1 down to 1—9—4—2, but the standard tests may be taken as 4—7—4—1 and 2—8—4—2.

"Medium spinning fibre are generally required to test 0—8—6—2 and may be mixed with the better grades for textile manufacture.

"Magnesia and compressed sheet fibre average 0—5—8—3. These fibres are used in the manufacture of magnesia pipe covering and compressed sheet packing.

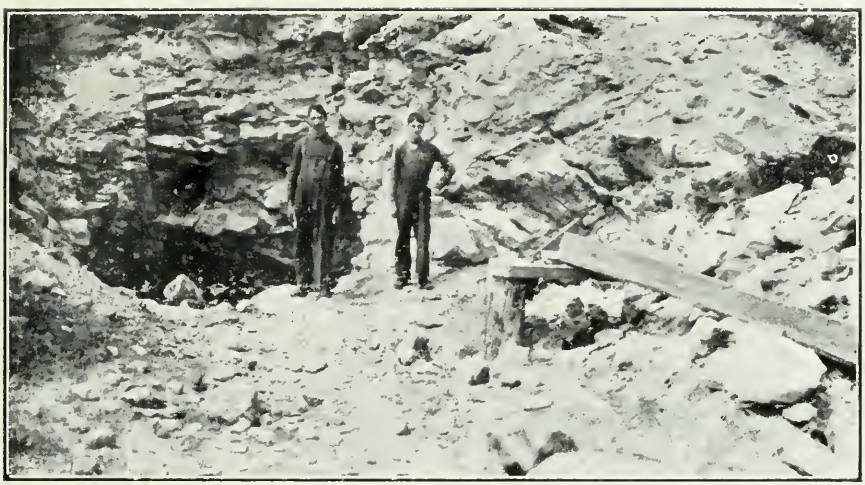
"There are various grades of shingle stocks—each mine having a different method of determining what constitutes a shingle fibre. The best known material, however, test 0—1½—9½—5. Some mines make 0—3—9—4— ; 0—1—11½—3½, although the standard shingle stock calls for a test of 0—1½—9½—5. This material, as its name implies, is used in the manufacture of asbestos shingles, corrugated asbestos lumber, and switchboard panels, and is used in conjunction with portland cement.

"Paper stock tests are the nearest standardized tests among the miners. They test either 0—0—10—6 or 0—0—11—5. The common designation for paper stock is "XX" fibre. This material is used for making asbestos paper and millboard and is sometimes mixed with the longer grades of shingle stock.

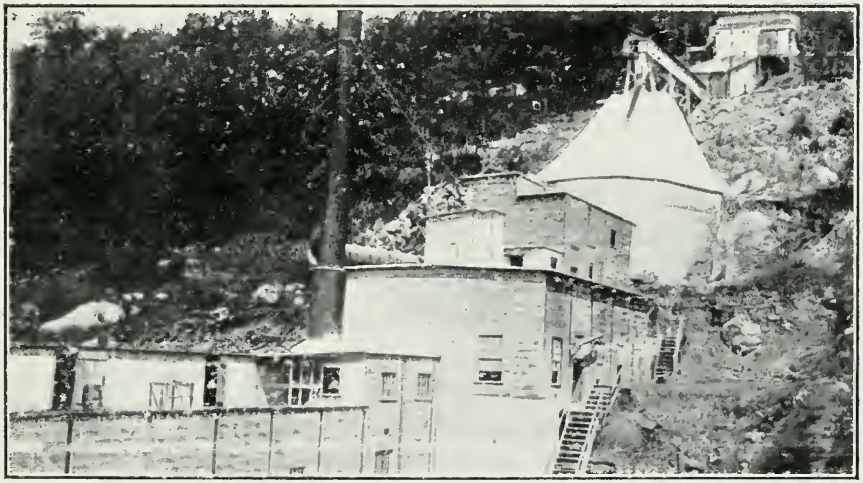
"Paper stock tests on the average 0—0—10—6 and is used in making asbestos paper or mixing with shingle stock.

"Cement stock, a cheap grade of merchantable asbestos, may test 0—0—5—11 or 0—0—6½—9½. It is used in the manufacture of asbestos boiler and roofing cements and for making millboard.

"Floats or shorts are sold on color and used in the manu-



Prospecting a deposit of laurentian asbestos on lot 10, range VIII of Kilkenny township, Montcalm county.



North American Magnesite Producers, Limited.—Sintering plant at Calumet

facture of flooring. The grade is usually pulpy and sandy in nature."

Uses of Asbestos.—

The average price of the asbestos produced from the Quebec deposits has increased nearly three fold in less than ten years. From less than $28.—a ton in 1912, it had risen to $82. in 1920, but fell back slightly in 1921. In the long fibre qualities the increase is even more marked. Crude No 1 in 1912 sold for $265 on average, and for $1200 in 1921. The increased demand and corresponding rise in prices, are due, to some extent, to new uses found for asbestos, but the main reason is found in the great extension and development of the known uses, rather than to new applications and utilizations. The long fibre qualities are spun and woven into fire-proof fabrics, which are utilized for theatre fire-curtains ; gloves, leggings, spats and aprons worn for protection against excessive heat and molten metal spattering in steel-mills, smelters, foundries, and metallurgical plants. But by far the greater bulk of the asbestos produced is used for purposes much less obvious to the average observer. Being a mineral inorganic substance, with great heat-resisting qualities, and being moreover a non-conductor of electricity, asbestos resists climatic conditions, weathering, decay and deterioration, much better and more effectively than vegetable or animal and other organic substances or compounds, such as cellulose, rubber, wool, leather. It is therefore used in the manufacture of steam-packings and packing sheets, washers, gaskets, of all of which there are innumerable varieties; of insulating tubes, tapes, wire and underground-cable coverings, used in electricity ; of brake linings for hoists, automobiles, elevators, and other machinery ; of heat insulating coverings, mattresses, laggings, for steam-pipes, locomotive, marine and stationary boilers ; fire-proof felts and papers, for linings of fire-proof safes, steel filing-cabinets ; filtration packings, high temperature cements. A large quantity of asbestos is also used in the manufacture of fire-proof building materials, such as asbestos shingles, asbestos boards, corrugated roofing and sheating, which are composed, in

the main, of Portland cement to which is added a proportion of 15% of asbestos fibre.

It is interesting to note that suits and garments of asbestos-cloth were recently used in successfully extinguishing a burning oil well at Long Beach, California. The well had been cemented at a depth of 2640 feet, when an explosion took place and the escaping gas became ignited. Such was the force with which the gas issued that the ignition took place 12 feet above the point of discharge.

Attempts to smother the flame with steam and mud flow were unsuccessful and it was decided to make use of dynamite. A stand 7 feet high was encased in asbestos and on this it was proposed to place 100 lb of 80% gelatine dynamite, wrapped in asbestos paper. To approach sufficiently near to the well to place the stand, it was necessary for two of the men to wear asbestos suits, dressed in which they placed the stand near the burning well, carried the powder and placed it on it, and the charge was exploded by battery. The explosion extinguished the flame, and this permitted to set up additional boilers and laying lines of pipes to direct huge streams of steam and mud into the hole to choke off the gas. It was not until three days' work with steam and mud that sufficient stoppage was produced to completely shut off the gas. (1)

Asbestos in Other Countries

United States.—No figures of production for Arizona in 1921 are as yet available, but, it was small, as the mines in the Globe district were very inactive, and reports towards the end of the year indicated that all mines were shut down at the time, and that the prospects for a resumption were not bright.

Renewed interest is being taken in the asbestos deposits of

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(1) Engineering and Mining Journal, December 24th, 1921.

Long Beach gas-well, estimated flow one hundred million cub. ft daily, which caught fire and was extinguished with the help of asbestos suits.

Man dressed in an asbestos suit, to approach gas-well on fire at Long Beach, California

Caleveras county in California, and at the end of 1921 a mill was under construction by the Pacific Asbestos Corporation, to treat the asbestos rock of the Copperopolis district.

Rhodesia.—According to the reports of the Rhodesia Chamber of Mines, the production of asbestos of Rhodesia during the 12 months ending December 31st 1921, amounted to 19,529 long tons, valued at £795,701.—or 21,872 short tons. The value however, comprises "adjustments on sales" for the years 1919 and 1920, to the amount of £328,410, leaving for the value of the 1921 production an amount of £467,291. Compared with the production of the previous year, 21,082 tons, an increase of 4% in the tonnage is recorded. The values as published cannot be compared owing to the adjustments, which do not cover regular periods.

That the asbestos industry of South Rhodesia was active during the year is shown by the fact that shipments were made from twenty-three mines, of which 13 are situated in the Bulawayo district (Shabanie) ; nine in the Victoria district and one in the Lomagundi district. The following were the operators of these mines : — Willoughby Consolidated, Ltd ; African Asbestos Mining Co ; Rhodesia and General Asbestos Corporation ; Ad Valorem Asbestos and Mining Co ; Hoole and Dures ; Jessie Tributors ; Slip Syndicate ; V. S. Welsford ; British Asbestos and Chrome Co ; St. Anthony Mining Venture ; F. M. Perkins.

According to the report of the Rhodesia Chamber of Mines, the following prices, were ruling in London, during the month of December 1921, for Asbestos from Rhodesia and South Africa per gross ton : —

Blue No 1 £45 ; No 2 £34 ; No 3 £25 ; Short blue £20.— White, ½ in. to ¾ in. £50 ; ¾ in. to 1¼ in £80 ; 1¼ in. to 2 in. £175

The following notes taken from the annual report of the Secretary for Mines of Southern Rhodesia for 1920, are interesting as they give a very clear conception of the asbestos industry in that country.

"The asbestos industry was thoroughly sound throughout "the year, and the demand for fibre showed no diminution. The "road facilities for conveyance of asbestos from the principal "producing mines, situated in the Belingwe and Victoria dis- "tricts, were considerably improved, and the wagons experienced "no difficulty in reaching rail-heads during the year. The prin- "cipal trouble during the latter end of the dry season in the "Belingwe district was the limited amount of grass for the large "number of oxen employed for transport purposes. It is esti- "mated that about 3,500 oxen were constantly employed to re- "move the asbestos from the Shabanie fields to Selukwe, a dis- "tance of 68 miles, and though arrangements were made to create "depots along the road to store grass and other food, the oxen "fell off in condition and great difficulty was experienced in "transporting the output of asbestos. Large sums of money "have been and are being spent at the Shabanie fields on develop- "ment and plant, and it is essential that more permanent faci- "lities should be created to regularly remove the output. A "railway to the fields has therefore been seriously considered, "and the route has been surveyed, and it is expected that the "work of commencing the laying of a railway line will not be "long delayed. A large number of claims were pegged between "Shabanie and the village of Belingwe, as slip-fibre of good qua- "lity was discovered there. Work on these claims has been in "progress, but it is as yet too early to definitely ascertain the "value and size of the deposits.

"In dealing with the output and value of asbestos for 1920, "it may be mentioned that a large quantity of asbestos of lower "grades was sold during the year by one company at Victoria at "prices which ranged down to £1 per ton. The asbestos was ori- "ginally considered to be unsaleable and really is dump asbes- "tos, but it was found that it could be used for trade purposes "and accordingly was shipped. This output, however, reduces "the output value as compared with the previous years. The ad- "justments on receipt of account sales were also not so heavy "as in 1919. These two causes explain the reason why, although

"the output is much higher, the value does not reach a corres-"ponding figure. For declaration purposes asbestos is valued at "between £15 to £25 per ton, subject to adjustment on sales. The "output in 1920 shows a considerable increase, as 18,823 tons "were declared, of a value of £459,572, as compared with 9,799 "tons, valued at £425,240. When the final value figures for "1920 are received the total value for that year will be much "higher, as the adjustments will be heavy, and, as has been re-"corded in a previous report, the 1919 figures were inflated by "adjustments extending over two years".

Union of South Africa.—The latest available official figures of production of asbestos for the Union of South Africa are for 1920. According to the report of the Department of Mines and Industries, of the Union of South Africa, the output of asbestos for 1920 totalled 7,112 tons, valued at £114,195, subdivided as follows : Transvaal 3,541 tons valued at £41,183 ; Cape 3,526 tons valued at £71,875 ; Natal 45 tons valued at £1,137.

The Transvaal output probably represents amosite in very large proportion, while the Cape output is almost altogether blue asbestos or crocidolite.

Unofficial figures for the first ten months of 1921 give the value of the output of asbestos of the Union of South Africa at £88,453, which would probably represent a quantity of about 4,500 tons.

In 1919 the production of the Union was 3,932 tons valued at £66,426. Large increases are therefore recorded for both 1920 and 1921.

COPPER AND SULPHUR ORE

The shipments of copper-bearing pyrite during the year 1921 fell off to 1,986 tons, valued at $10,463. This is the smallest production recorded since mineral statistics have been collected by the Provincial authorities. The figures for the previous year had been 15,186 tons valued at $98,854.

When these figures are compared with the production of a

few years ago, when the shipments attained their maximum in 1918, for which year they were 125,446 tons of a value of $1,319,690, it is apparent that the present conditions brought about by the supplanting of the iron pyrites by crude sulphur, and by the fall in the price of copper, are having a very serious effect on the copper industry of the Eastern townships.

The Weedon Mining Company operating the McDonald mine, at Weedon, is the only one who reported having made any shipments. This mine was operated during the three first months of the year and closed down, in the early part of May. The mine has been kept pumped out, but the hoisting cable has been taken out. Considerable development work was done on the 13th level, 1150 feet from the surface, and should market conditions warrant it, it is possible that on resuming operations, the company may build a concentrator.

The Quebec Megantic Copper Co. Ltd, was organized and incorporated to develop and operate a copper deposit on lot 8, range 1 of Inverness township, controlled by Mr. W. F. Lindenau.

The deposit was visited in October by an officer of the Bureau of Mines. It is distant 17 miles, by road, from the station of Black Lake, on the Quebec Central Railway, and 16 miles from Ste Julie on the Grand Trunk railway. At the time of the visit, on October 18th, the work consisted of three openings on two mineralized zones, distant 75 feet from each other.

The first excavation was 30 feet long, and 14 feet at its greatest depth. It is on a band, or dyke, of greenstone, on a contact between sericite schists and a hornblende schist. In the bottom of the pit a mineralized zone, 18 inches wide, is composed of stringers of sulphides, mostly chalcocite, in a greenstone gangue. This zone is cut by an 8-inch vein of white quartz. An analysis of a sample across the mineralized band gave 2.15% copper.

The second opening is on the second zone, and it has un-

covered a quartz lens, 30 feet long, 8½ feet wide, and well mineralized with chalcocite. A sample taken across the lens gave 13.27% copper.

A grab sample on a small dump of ore, from the first opening, gave on analysis 17.8% copper.

The work done was not sufficient to be able to judge of the importance of the deposit. Since then, a contract to sink two exploration shafts is said to have been awarded and the work begun.

La Compagnie Minière de Glendyne, Ltée, at Glendyne, worked on their prospect, lots 34 and 35, range VIII, Botsford, sinking a shaft 8 ft. x 8 ft. to a depth of over 40 feet.

The Glenama Mining Company, has done considerable work on lot 57 range "A" of the township of Milnikek, in Bonaventure county near the Intercolonial railway. The workings consist of an adit, inclined 18°, into the side of the hill. The first 20 feet consist of a trench, and the next 40 feet are underground, in the rock. Near the end of the incline a vertical shaft, 37 feet in depth has been sunk. The incline follows a quartz vein, 5½ feet wide, cutting the slaty rock. At the face of the adit the quartz is stained greenish with copper carbonates. The quartz of the vein is partly rusty and partly white. Two samples were taken by an officier of the Bureau of Mines, at the face ending the incline, and 20 feet from the end. Both samples gave negative results for copper, gold and silver.

CHROMITE

The total shipments of chromite from the Coleraine district in 1921, amounted to 1893 tons, valued at the mine, at $22,696. Only one mine was operated, that of the *J. V. Bélanger Mining Company,* lot 19 S. E., range X of Coleraine. This mine was operating during the early part of the year, but closed down for a few months, was reopened in June, and was worked for some time by the Union Chrome Mining Company. The chrome

was shipped to the United States Ferro-Alloys Corporation * who were financially interested in the J. V. Belanger Mining Company.

The flow sheet of the mill was somewhat altered and on resuming operations in June it was as follows : — Bin, trommel, bin,—ball mill, Callow screens, two Callow cones, six sand tables, the middling of which goes to a second ball-mill and to four sand-tables. The undersize from the Callow screens are sent to Callow cone-shaped tanks, and the fines to six Diester tables. The Lowden dryer, for concentrate, which was put in in December 1920 was operated. The concentration of the ore to chromite, is about 7 to 1. Under the new flow-sheet the mill was treating 150 tons in two shifts.

The J. V. Belanger Mining Company went into liquidation, and the properties, both mine and mill, were sold by sheriff, at public auction, in November 1921, and bought in by the United-States Ferro Alloys Corporation, 30 East 42nd treet, New York, who are now the owners.

The mine and mill of the *Mutual Chemical Company, of Canada Ltd*, closed down at the end of 1920, and were not reopened during 1921. Some of the machinery was dismantled and shipped away. The mine workings are now full of water.

The chrome properties of the *Black Lake Asbestos and Chrome Co*, were finally closed down in October 1920, and in 1921 the head-frame of the Caribou mine was dismantled.

CHROMITE IN RHODESIA.—In 1921, Rhodesia produced 50,188 long tons of chromite ore, the market quotations for which varied from £6 a ton in January to £5 in December, for a standard of 50% of sesquioxide of chrome, c. i. f., United Kingdom ports. With the resumption of normal facilities of ocean freight traffic, the chrome industry of Rhodesia is again resuming the importance it had attained before the war.

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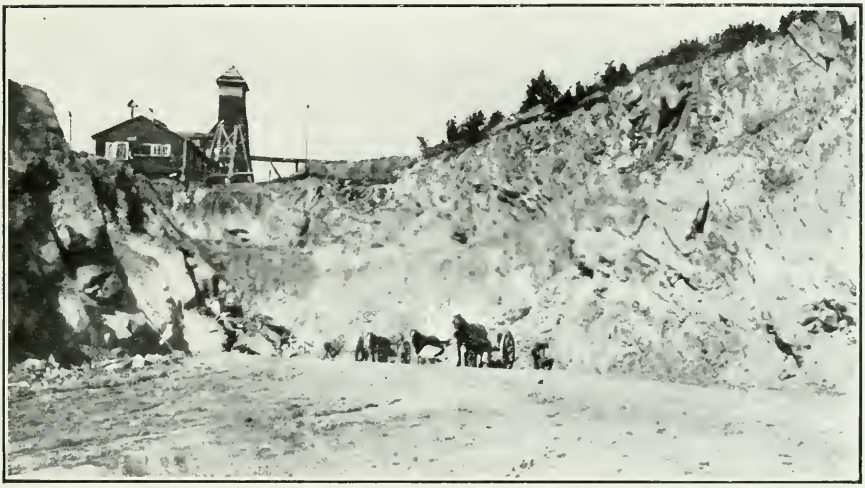
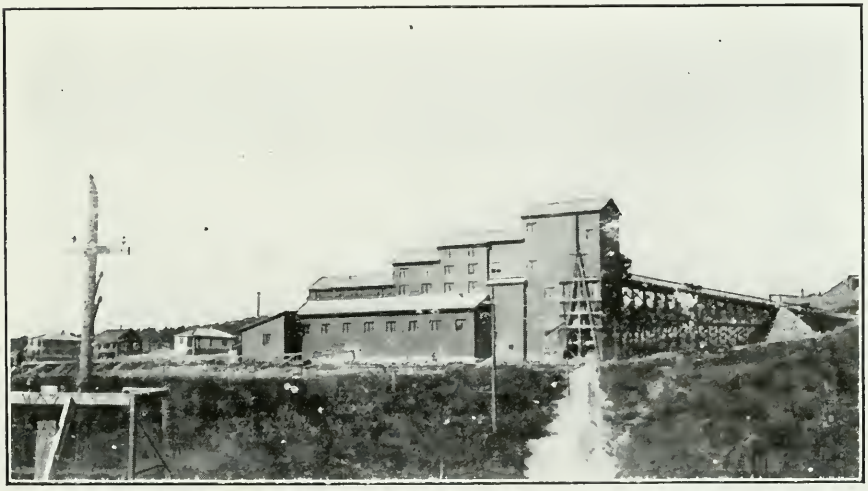
* Erroneously mentioned as "American Ferro-Alloys" in the report for 1920.—



J. V. Belanger Mining Co., Ltd.— Chrome deposit in Coleraine township, worked by quarry method.



J. V. Belanger Co., Ltd.— Concentrating mill in Coleraine township.

MOLYBDENITE

Although no molybdenite was produced in Quebec in 1921, the question of the uses of molybdenum in the steel industry, received considerable consideration, and revived interest in the molybdenite deposits of Quebec.

The molybdenite deposits of the province have been described in past reports of the Quebec Bureau of Mines. The work done during the year was unimportant, and in some cases rather perfunctory. The following made report of some work done : —

L. N. Benjamin, lots 1 and 2, range I of La Corne township, where a shaft was previously sunk. The report mentions that a company is being organized to develop and work the deposit in the spring of 1922, and the plans contemplate the erection of a mill.

The St. Maurice Mines Co. Ltd, who own molybdenite deposits on the Indian Peninsula, Lake Kewagama, restricted the work to the upkeep of the mill building and putting in order the machinery, so that work could be resumed without delay as soon as conditions should warrant it.

The Daley Molybdenite Company, during the first five months of the year did some further exploratory work, drifting and cross-cutting, on the molybdenite workings on the South half of lot "J", township of Thorne, Pontiac county. Moreover, repair and maintenance work was done on the surface plant, as well as fuel wood cut. Work was suspended in the early part of June.

That great interest is taken in the industrial application of molybdenum in the manufacture of special steels, is shown by the numerous papers and articles which appear in the technical press. Reviewing the situation in the Engineering and Mining Journal, Mr. Phillipson, of the Climax Molybdenum Company states that "greater progress was made in the commercial development of the metal in 1921 than during the entire preceding

four years. The reasons for this statement will be apparent if the following technical papers on the subject are read : "A suggested Method for determining the comparative efficiency of certain combinations of alloys in steel," by J. D. Cutter ; "A discussion of Molybdenum steels," by Charles McKnight ; "Molybdenum steel and its applications" by M. H. Schmid. These three papers appear in the Transactions of the American Society for Steel Treating, in December 1920, March 1921 and June 1921, respectively. Further interesting information and pertinent data will be found in "Molybdenum Steels" by John A. Matthews in transaction Am. I. M. and M. Eng., February 1921 ; "Molybdenum" by Arthur H. Hunter, Am. Iron & Steel Inst., May 1921 ; "Application of chrome-molybdenum steel, from the Consumers Standpoint", by C. N. Dawe, read before the Society of Automotive Engineers, February 1922.

"From the purely technical standpoint, the fact that steels containing molybdenum in fractional percentages, ranging from 0.15 to 0.75, but never exceeding 1 per cent, have been extensively adopted as standard by some of the foremost manufacturers of automobile parts, as well as in the manufacture of such other products as die blocks, drop forge piston rods, shovels, pneumatic tools, railway parts, mill rolls, seamless tubing, and similar products, indicates the quality of the molybdenum steels".

According to Mr. Arthur H. Hunter molybdenum steels, as a class, when compared with other alloy steels which are in the same category from a commercial standpoint, treated to the same tensile strength, show : —

1.—A slightly higher elastic limit, hence a somewhat higher elastic ratio.

2.—A higher elongation, hence greater ductility.

3.—A much higher reduction in area, hence appreciably greater toughness.

" This latter property (toughness) is probably the most pronounced individual physical result of the addition of molybdenum to steel. From a great deal of data covering these three

points, the following tests were chosen as exemplifying them in the simplest manner. The tests were made under the supervision of of Dr. J. S. Unger, of the Carnegie Steel Company.

"Five steels, embracing only the accepted commercial tonnage type, analyzing as shown in Table I, were all heat-treated to give the same tensile strength, i. e., approximately 125,000 lb, per square inch. The results were as shown in Table II.

Table I (Analyses)

	Type of steel	*C*	*Mn*	*Ni*	*Cr*	*Mo*
1	Carbon	0.62	0.45	—	—	—
2	Chrome	0.49	0.53	—	0.60	—
3	Nickel	0.40	0.65	3.61	—	—
4	Chrome-nickel	0.43	0.57	1.60	0.46	—
5	Chrome-molybdenum	.0.32	0.72	—	0.80	0.27

Table II (Physical Properties)

	Type	Tens. str. lb. sq. in.	Elast. Lim.	Elast Ratio.	Elong. % in 2 in.	Red. area %	Izod Ft. lb.
1.	Carbon	126,175	84,380	66.9	18.0	43.6	5.0
2.	Chrome	125,300	107,225	85.6	18.0	56.5	66.5
3.	Nickel	127,975	112,525	87.9	18.8	51.4	54.5
4.	Chro. Nick.	127,975	111,025	86.8	19.8	60.3	54.0
5.	Chro. Moly.	125,650	112,250	89.3	21.0	68.0	90.0

"It should be noted that tests by the Izod machine on those steels showed chrome-molybdenum to possess a resistance to impact of eighteen times that of the carbon steel, and 34% greater than the nearest alloy steel. As the impact test merely measures the work of rupture under a suddenly applied load, these results which have been amply corroborated, show clearly the cumulative effect of the higher elastic ratio, elongation and reduction of area for a given tensile strength possessed by the molybdenum steel".

In connection with the above it is interesting to read the statement made by C. N. Dawe, Metallurgist to the Studebaker

Corporation, in a paper read in February 1922 before the Society of Automotive Engineers : —

> " The Studebaker Corporation of America has had made and " shipped to its plants over 2,000 tons of molybdenum steels " of various analyses. This steel has been put through pro- " duction in the form of rear-axle shafts, transmission gears " and shafts, steering knuckles, steering-knuckle pins, ring- " gears, and drive pinions ; in fact all parts for which alloy " steel is specified. Our first efforts were to determine the " advisability of the adoption of that class of chrome-molyb- " denum steel which would be adaptable to heat-treated forg- " ings, such as steering knuckles, steering gears, steering " arms and rolled axle shafts, water quenching of these " being desired. By a process of elimination it becomes clear " that steel containing molybdenum approximately 0.30 to " 0.40 per cent, with chromium 1.00 per cent, and carbon " above 0.30 per cent, should be avoided when water is de- " sired as to quenching medium, and where cracker shearing " is used. An analysis showing carbon content below 0.30 " and above 0.23, with a chromium content of 0.70 to 0.90 " per cent, and molybdenum 0.30 to 0.40 per cent, gives sa- " tisfactory results with water as a quenching medium, there " being no cause for concern pertaining to the development "of quenching cracks.

The use of the chrome-molybdenum steels for the manufacture of special parts in the automotive industry appears to be an accomplished fact. We may therefore expect in a near future an active resumption in the production of molybdenite.

ZINC AND LEAD

The Tetreault mine, at Notre Dame des Anges, Portneuf county, operated by the *Zinc Company, Limited*, is the only one of the zinc-lead mines which reported having made shipments of ore. This mine was operated during the three first months of 1922, during which period 778 tons of lead concentrate was disposed of, valued at $18,080.27 for the lead content. Owing to

the lack of demand none of the zinc concentrate was shipped.

The lease in virtue of which the Zinc Company operated the Tetreault mine expired in 1922, and not having been renewed the property reverted back to the owners, Mr. Pierre Tetreault, of Montreal.

The *Federal Zinc and Lead Company, Ltd,* carried on further development work on their mine in Lemieux township, in the region of the head-waters of the Cascapedia river, in Gaspé, and moreover worked on the construction of the road to connect the mine with the railroad at the station of Cascapedia, near New Richmond.

The underground development work at the end of the year stood as follows : — depth of No 1 shaft 257 feet ; length of drifting 1088 feet ; total cross cutting 880 feet, levels opened up at 100 feet and at 250 feet. These workings have blocked out a large amount of very good ore. Two other shallow shafts have also been sunk from the surface, 64 feet and 18 feet respectively. The lack of means of communication greatly militates against the more rapid progress of this mine, and to this drawback may also be added the depression of the metal industries, which has prevailed during the past two years.

The year has not been favourable to the development of new mines of ores of lead and zinc. The prices of these metals have shown very heavy decreases. The average price of zinc, in the form of spelter, in the United States, has been 5 cents a lb for the year 1921, as compared with 8.1 in 1920. Lead has shown an even more marked decrease, 4.5 per lb against 8 cents in 1920.

GOLD AND SILVER

The production of gold and silver shows a decrease as compared with 1920. It has been 648 ounces for gold and 39,327 ounces for silver, against 935 ounces gold and 57,514 ounces silver in 1920.

The precious metals produced in the Province of Quebec are

only by-products derived incidentally from the treatment of the copper, lead and zinc ores, and it is therefore natural that the figures of production should be proportional to the activities of the base metal mining.

There is at present no gold industry properly speaking, in the Province of Quebec, that is production of gold from quartz veins or from placer deposits, although the province possesses both kinds of deposits.

The gold placer deposits of the Beauce district, in the basin of the Chaudière river, have been known since 1823, and for many years were the object of active operations, more particularly between 1870 and 1885. The total value of the gold extracted from these deposits from the beginning of operations up to 1912, when the "Compagnie des Champs d'Or Rigaud-Vaudreuil" discontinued work, has been estimated at between 2½ and 3 million dollars. A detailed report on the geology of the "Beauceville Map-Area", by Dr. B. R. Mackay, was published in 1921, by the Geological Survey, Department of Mines, Ottawa, and to this valuable report, any one interested in the placer deposits of the Chaudière basin is referred.

Very promising areas containing gold bearing quartz veins are known to exist in North-Western Quebec, in the region south of the Transcontinental railway, east of the interprovincial boundary, between Ontario and Quebec. The geological conditions in this region are very similar to those prevailing in the mining regions of Ontario, such as Porcupine, Kirkland Lake, Larder Lake, and a gold mining industry will certainly develop in time. These areas have been referred to in the past reports of the Quebec Bureau of Mines, and in report of the Geological Survey of Canada.

While these two areas are the most prominent of the Quebec gold districts, the presence of gold quartz and of gold bearing sands has been observed in numerous other places in the Province.

TITANIFEROUS IRON ORE

There have been no shipments of titaniferous iron, or ilmenite, since 1918, and the large deposits of this mineral, situated on the North shore of the lower St. Lawrence, as well as to the north of Montreal in the Laurentian plateau, have been lying quite idle for the last three years. The shipments were never very large, but for a number of years a certain quantity was utilized for the manufacture of ferro-titanium.

According to "Chimie et Industrie", the accredited Journal of the "Société de Chimie Industrielle" of France, the "titanium white" or titanium hydrate, appears to be likely to take an important place in the paint industry, and to replace, in a measure, the white-lead which plays such an important rôle in the manufacture of paint. Titanium-white has a very high index of refraction, and consequently high covering power ; it is not poisonous ; and with linseed oil, it gives a paint which is not acted upon by sea water. One kilogram of titanium white, it is claimed, can cover 20 square meters, whereas one kilogram of white lead covers only 9.1 square meters.

The titanium white is prepared by pulverizing the ilmenite and treating it with hot commercial sulphuric acid, forming sulphates of iron and of titanium, which are soluble in water. On ebullition, the titanium hydrate is precipitated. This is neutralized by barium carbonate and calcined.

Another method of preparation consists in fusing the ilmenite in an electric furnace with fluxes. The fused product is dissolved in sulphuric acid, and barium sulphate is added and the solution is boiled, resulting in a mixture of barium sulphate and titanium hydrate. By calcination the precipitate is transformed into microscopic crystals.

Should these prove commercial processes, some of the Quebec ilmenites might be utilized in the manufacture of white paints.

MAGNESITE

The magnesite industry of the Grenville district has had a very poor year, the shipments having amounted to only 2927 tons, of which 870 tons were crude magnesite, 684 tons was calcined, and 1373 tons dead burned, the whole valued at $74,110. For the previous year the figures has been 4,296 tons crude, 3154 tons calcined and 10,491 tons clinkered, valued at $512,755. In the general table of the mineral production, on page 8 the tonnage of magnesite has all been converted into weight of crude magnesite, giving a quantity of 4984 tons.

The operators were the same as the previous year, viz : — The Scottish-Canadian Magnesite Company, Ltd, lot 15 range XI, township of Grenville ; the North American Magnesite Producers, Ltd, lot 15 range IX, Grenville ; and the International Magnesite Company, Ltd, lot 13 range I township of Harrington.

The plants of these operating companies were described in some detail in our report for 1920, so that only changes which were made during the year need be mentioned.

In the sintering plant of the *North American Magnesite Producers, Ltd*, at Calumet, the aero-pulverizer which had been installed for firing the rotary kiln was discarded. The apparatus did not give satisfaction on a horizontal rotary kiln as it is designed primarily to fire boilers and vertical kilns. The firing of the magnesite kiln is now done as in a cement kiln, by pulverizing the coal in a ball mill, and injecting it by a draft induced by a fan.

As mentioned in previous reports, in the dead-burning process of the Grenville magnesite some iron ore has to be introduced to supply the sintering qualities, to produce dead-burned magnesite. The ore used at Calumet is Port Henry magnetite.

The calcining kiln, at the quarry, was repaired and the system of firing has been altered from wood to coal. The calcined magnesite is used in the building trade in the manufacture of a

preparation for stucco work for outside walls ; the trade name of this product is "Firestone Stucco".

At the plant of the *Scottish Canadian Magnesite Company* the coal pulverizing plant which had been destroyed by fire during the early part of the year was rebuilt.

It was mentioned in our previous report, that laboratory investigations had been carried on by the Federal Mines Branch, with the object of devising a process to reduce the lime content in the dead-burned product. These investigations which were conducted on small samples have been followed by tests on larger quantities, carried on in the ore testing plant, and in the "Summary report on Investigations made by the Mines Branch during 1920",—the following report of progress was given.

"Ten barrels of crude magnesite, net weight 5,849 pounds, "were received March 26, 1920, at the Ore Dressing and Me- "tallurgical Laboratories, from the North American Magne- "site Company, Calumet, Quebec.—

"The magnesite is a mixture of magnesite and dolomite, "the magnesite predominating ; the dolomite being present "in sufficient quantity that the lime content of the crude "makes it compare unfavourably with the Austrian and "Grecian magnesites, or with that from the States of Wash- "ington and California.—

"The shipment received showed the following analysis : —

CaO	12.85%
MgO	34.94%

"Investigation is being carried on to obtain a separation of "the lime from the magnesia and to obtain a product that "will compare favourably with the foreign material.

"A number of tests have been conducted by calcining the "crude in a stack furnace at a temperature of 950° C. to "1100° C., slacking the calcines with a moderate amount of "water, and then classifying and washing the lime from the "calcined magnesite.

"The crude magnesite containing 13 per cent CaO on being "calcined gave 25 per cent CaO in the calcines. The test

"work so far conducted shows that this can be reduced to "9 per cent CaO in the magnesite product by classification "and washing. These results, however, are much higher "than desired, and further work is being carried on to im- "prove the methods of calcining, as it is in this part of the "operations upon which the success of the process will "depend."

MICA

The production of mica in 1921 totalled 288,197 lb, valued at $42,222. These are the lowest figures of production recorded since mineral statistics have been collected by the Provincial Government in 1898, when the production for that year amounted to 275 tons valued at $81,000.

The figures of mica comprise all grades of that substance shipped from the mines. The largest tonnage is scrap mica, which sells as low as $8. a ton. The highest grade of mica sold this year was some 4 x 8 sheets which brought around $5. a lb. Between these two extremes we have mica of all grades and prices.

The mica produced in 1921 can be roughly divided into four classes, as follows : — rough-culled mica 36,500 lb, valued at $4,091. ; thumb-trimmed 60,052 lb, valued at $21,903 ; thin-split mica 20,350 lb, valued at $15,366 ; the balance being scrap-mica valued at an average of $10. a ton.

The market has been very unsatisfactory, there being very little demand. The greater part of our mica is exported to the United States and to England. In 1921, the United States took 88% of the Canadian exports of mica, England 10%, and other parts of the world 2%.

The prices for mica which ruled during the second half of the year were as follows, although the demand was very small. The following quotations are for thumb-trimmed mica : —

1	x	1	.....	12	to	18c.	a pound
1	x	2	.....	17	to	25	" "

1	x	3	.....	23	to	35	"	"
2	x	3	.....	40	to	55	"	"
2	x	4	.....	65	to	90	"	"
3	x	5	.....	$1.25	to	$1.75	"	"
4	x	6	.....	1.50	to	2.50	"	"

GRAPHITE

There was no production of graphite by the mines themselves in 1921, the small quantity shipped, valued at $2422, having been shipped from stock on hand.

The return received from a new company *"The Standard Graphite Company"*, mentions that they have done some development and exploration work on their property, situated on lots 29, 30 & 31 range VI township of Boyer. The construction of a concentrating mill was begun in 1921, and it was expected to be completed early in 1922. A water power was also being developed to supply power for the mine and milling operations. The mill is near Guénette, on the C. P. R. line to Mont-Laurier.

FELDSPAR

The production of feldspar in 1914 amounted to 9,797 tons valued at $79,752. In 1920, the figures were 849 tons valued at $11,252, and this substance is therefore one of the very few in which we record an increase in the production for the year 1921. In fact, it is the highest production ever recorded since mineral statistics have been collected in the province.

This is due to the impetus given to feldspar mining by the discovery and development of some remarkable deposits in the Buckingham district, and there is no doubt that the production of feldspar, from now on, will increase and that it can be recognized as a permanent industry.

In the report for 1920, mention was made of the opening up of a promising deposit of feldspar which was being developed by

Messrs O'Brien & Fowler on lot 8 range I of Derry township, in the county of Labelle. This mine was the largest shipper in 1921 and the deposit has fully come up to the expectation of the operators. This deposit, which constitutes the Derry feldspar mine, was visited during the summer of 1921 by an officer of the Quebec Mines Branch.

It is situated about nine miles from Buckingham, to the north-east of this town. The operators built a road, nearly two miles long, connecting the quarry with the main road. The deposit which is situated 300 feet above the level of the valley, is opened in two benches, showing a combined height of 40 feet of face. It is a pegmatite dyke of almost pure feldspar. The deposit shows a width of 50 feet of workable spar and it has been proved over a length of 300 feet along the strike. To the west the wall is well defined gneiss. Right in the middle of the workable spar is a narrow vein of quartz, up to 12 or 14 inches wide, which can very easily be picked out. To the east the feldspar dyke passes into a graphic granite which is high in quartz in places, but the workings do not touch this graphic granite, which could easily yield important quantities of standard feldspar. The spar as now shipped is practically pure orthoclase. The analyses of carload lots give 10 to 13½ per cent of potash, 1 to 1½ soda and 4 to 5 per cent free silica.

The spar is hauled to a landing on the Lièvre river, 3 miles from the mine, is there loaded on barges, by dumping down into a chute, and towed to Buckingham, where it is loaded on cars. In winter it is hauled to Buckingham, 9 miles, by snow road. The spar is shipped to a grinding mill, near Rochester, from which it is sold to the pottery trade.

Another very likely deposit, the property of Mr Pedenaud lot 14, range XII of Buckingham, is situated close to the Derry quarry. Messrs O'Brien and Fowler have contracted for the output of this quarry.

In August the *Buckingham Feldspar Company* began development work on an analogous deposits, on lot 9, range II of

Derry, and although no shipments have been made in 1921, it is very likely that this quarry will be an important producer in 1922.

In these Derry deposits the purity of the feldspar is remarkable. A part of the material is translucent, approaching adularia in character.

A common feature of such acid pegmatite dykes, which appear to be numerous in the district, is that they are likely to contain rare earths. At the old Villeneuve mine, which in a straight line is less than 10 miles distant from the Derry quarry the presence of uranium and yttrium has been noted, although not in workable quantities. The granite dykes of Norway and Sweden yield cerium, zirconium, thorium, as well as uranium and yttrium.

A very appreciable quantity of feldspar was shipped by *Mr. W. G. Masson*, of Ottawa, from a deposit near Marks station, lots 47 and 48, range IX of Aylwin township. This feldspar is albite, the soda feldspar, rather than orthoclase, and is used in the manufacture of scouring soaps and powders rather than for the pottery industry.

MINERAL PAINTS

Natural Iron Oxides and Ochre

The total shipments of natural iron oxides from Quebec deposits in 1921 amounted to 8,894 tons valued at $90,765. This is a decrease when compared with the shipments effected in 1920, when they amounted to 19,185 tons, valued at $136,098.

The iron oxides produced in Quebec may be subdivided into two classes, the raw oxides which are marketed without any preparation, and which are used in the manufacture of coal gas, as a purifying agent to absorb the hydrogen sulphide from the gas, and the calcined oxides which are further treated for the manufacture of paints. The average prices of these two products in 1921 were respectively $2.70 and $35. a ton.

The natural iron oxide deposits worked in the Province of Quebec are as a rule of very high grade. Much of the calcined material assays over 90 per cent iron oxide and some reach 98 per cent and more.

In 1921 only two deposits were worked, both of them in the region of Trois-Rivières, but there are in the Province numerous deposits of this nature.

In this connection it is interesting to note that Mr. Howells Fréchette, of the Federal Mines Branch, has made a special investigation of the iron oxide and ochre deposits of the Province of Quebec, and the following descriptions are taken from his preliminary report given in the Summary reports for 1919 and 1920 of the Mines Branch, of the Department of Mines, Ottawa. It is his intention to eventually publish a full report on these deposits, giving also results of numerous analyses and tests.

" (*) Many deposits of ochre and iron oxide have been reported from various sections of the Province. Practically all of these, with the exception of certain remote deposits and those lying east of Quebec, have been visited, and where it was deemed desirable, samples were taken for laboratory examination and testing. In the southern part of the Province no large deposits were seen, and but few that have any commercial possibilities.

Three Rivers and Vicinity

"The more important occurrences of ochre lie to the North of the St. Lawrence river. One group of such deposits is situated a short distance to the east of Three Rivers, between Cap de la Magdelaine and Champlain, about two miles north from the St. Lawrence. In this area, at Red-Mill, the Canada Paint Company, Ltd, operates an extensive plant for calcining, washing,

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* Iron oxide pigments in Quebec. Summary reports 1919 and 1920, Mines Branch, Ottawa.—

and grinding pigments from its deposits. A variety of shades of red, umber, and sienna are produced.

"The plant and deposits of the Champlain Oxide Company are about 1½ mile east of Red-Mill. This company operates a calcining plant, which is situated near the deposits, and a grinding and packing plant beside the Canadian Pacific Railway tracks.

"For a number of years Thomas H. Argall, of Three Rivers, produced calcined red oxide from his deposits two miles east of those of the Champlain Oxide Company. Owing to labour troubles, he closed his plant and transferred his business to Pointe-du-Lac, where he now ships uncalcined ochre for use in the purifying of illuminating gas. He obtains this material from a series of deposits lying about one mile to the north of his warehouse, which is beside the Canadian Pacific Railway tracks, nine miles west of Three Rivers.

"About thirty years ago the Radnor Paint Company operated a calcining and grinding plant at Proulx, Champlain county. The crude ochre was obtained from rather irregular deposits along the beds of the small brooks which join and flow into the St. Maurice river a short distance south of Grandes Piles. This property is now owned by the Laurentide Company, of Grand Mère, and is within the area set aside by them for reforestation.

"To the south of the St. Lawrence river, in the sixth range of Gentilly, there is a rather extensive deposit of ochre between the base of a high sand hill and the Gentilly river. In places the ochre is rather sandy. Several years ago this deposit was worked to a limited extent by Ouellet and Thibaudeau. Two small calcining furnaces are all that now remain of the equipment. The deposits are situated six or seven miles from the railway and hauling had to be done over poor roads.

Portneuf County

"About two miles to the south west of St. Raymond, on the property of Remi Cayer, there is a deposit of ochre in a bog lying between the main road and the Ste Anne river. This was worked on a small scale about 25 years ago by Piché and Allan. The bog, which is about four or five acres in extent, could be drained easily by means of a short ditch to the river bank. In places the ochre is very shallow, while elsewhere it exceeds six feet in depth. In general it is free from sand. This was the only deposit of any importance seen in this county.

Montmorency County

"On the property of Joseph Racine, 1½ mile west of the Taschereau Parent bridge over the Ste Anne de Montmorency river, and lying about a quarter of a mile north of the road, there is a deposit of ochre of considerable extent. In shape it is somewhat like an open fan and measures about 1,000 feet by 500 feet. The depth, where ascertained, was found to range from a few inches to a maximum of less than ten feet, the average being three feet. The ochre, in some parts of the bog, is underlain by woody peat which could not be penetrated by the sampler. It is possible that this peat may, in turn, be underlain by more ochre. It has been stated that samples of ochre were obtained at a depth of twenty feet or more. It may be that misleading results were obtained through using an open pipe sampler. Much of the ochre is free from grit, though sand is carried into portions of it by small brooks and by the overwash in very wet weather. This property has never been worked.

Labelle County

"The Paint Products Co., of Canada, Ltd, has recently erected a large plant for washing, calcining, and grinding pigment at its ochre deposits on lot 18, range IV, Lynch township. The deposits are large and yield a variety of colours, both raw and calcined. In places the ochre is somewhat contaminated with sand, while elsewhere it is apparently free from grit. As

yet only a preliminary examination has been made. It is said that between 25 and 30 acres are underlain by ochre. The maximum depth could not be determined, as it exceeded the length (12 feet) of the sampling drill.

"While operating to a limited extent at the time of the visit, in September, much of the work was still in the experimental stage. The nearest point of shipment is Annonciation, on the Mont Laurier Branch of the Canadian Pacific Railway, which is distant fourteen miles by road.

Drummond County

"In the southern section of the Province, as already pointed out, no large deposits of ochre were seen. One, however, is worthy of mention. While from a hurried examination the quantity of ochre did not appear to be great, it is of decidedly good quality. When wet it is bright yellow, and when ground in oil after air drying it produces a very good tone of sienna with strong tinting power. This deposit lies along a small stream on the farm of R. W. Billingsley, on lot 4, range IV, Durham township, Drummond county.

Saguenay County — Iberville Township

"The only deposits of importance seen in that part of the Province of Quebec visited in 1920, are situated on the property comprising lot 18, rangeI, and lots 19, 20, 21 and 22, range II, Iberville township, Saguenay county, near the mouth of Petite Romaine river, which flows into the St. Lawrence river at a point about 130 miles below Quebec. Iron oxide has been deposited in a more or less crescent-shape deposit, or series of deposits, about three-fourths of a mile in length, along the southern margin of a very large bog. The ochre varies considerably in depth. In places, on the flat, it approximates four or five feet in depth ; while in some gullies the depth is greater. Twelve feet of ochre was observed in one place, and it is said that in another, drilling revealed over eighteen feet of the mineral. Several shades of ochre were seen, and duly sampled for testing.

"These deposits were first worked as a source of pigment, in 1883, but were later abandoned. In 1916, work was again started, and a small quantity of crude ochre was produced for use as a pigment in paper making. Since then, several small shipments have been made. At the time of my visit, a company under the management of Mr. P. L. Jobidon, had begun the installation of a plant for calcining and grinding the ochre for paint. There is no railroad in the district, shipments being made by small schooners, which are loaded at low tide.

"Deposits which are said to be of considerable size, are known to occur in the township of Manicouagan on the north shore of the St. Lawrence . Owing to their remoteness from markets, and the difficulty of reaching them, they were not visited.

"To the south of the St. Lawrence, ochre was observed in a number of places, but nowhere were any deposits seen that could be classed as of commercial interest.

"In addition to the deposits mentioned above, many of lesser importance were visited and sampled, in various section of the Province, including the Ottawa valley as far west as Waltham.

"The sampling was done by means of a drill designed especially for the purpose. It is similar to the regular open side scoop drill, but has a rotating shutter whereby the aperture may be closed while the drill is driven to the desired depth, opened to receive the sample, and again closed for withdrawing the drill. This drill was found to work well, and it is considered that the samples taken by it are truly representative of the material.

"During the winter, the samples collected were tested in the laboratory to determine their worth as raw material for paint manufacture. A series of calcining tests was conducted under varying conditions of temperature and composition of atmosphere. A wide range of calcined colours were produced from the common "red oxide", to burnt umber and rich purples.

A full record of these tests will be included in the final report."

OIL SHALES

During the last two years considerable interest has been devoted to the possibilities of oil shales in various part of Canada, as a source of petroleum by distillation.

The presence of oil shales in Gaspé has been known for a long time, and as it had been reported recently, that large quantities of rich shales of this nature occur in the township of Port Daniel, outcroppings of which are seen all along the banks of the river which empties at Port Daniel, Mr. Louis Simpson, of Ottawa, made a thorough investigation of this material during the summer of 1921.

Although his report has not been made public yet, it is understood that the result of his search in Port Daniel for deposits of this nature which might offer economic interest was very disappointing. No oil shales or other deposits were found that were of commercial interest, the claims made having no substantial foundation.

The investigation of oil shales in Canada has already been the subject of a report published in 1910 by the Department of Mines of Canada. We reproduce here the part which relates to the Province of Quebec.

"In the Province of Quebec, the occurrence of shales of the character just described (oil-shales) is rarely seen. The carboniferous rocks are not exposed west of Chaleur Bay in Gaspé peninsula, but there is a large development of Devonian sediments in that area, the whole thickness of which aggregates over 7,000 feet. While oil-springs are found in the vicinity of Gaspé basin, at the eastern extremity of the peninsula, all attemps at finding petroleum in economic quantity by borings have as yet been unsuccessful.

"At several places beds of bituminous or oil-shales are seen,

varying from a foot to 15 inches in thickness, but in so far as examined these beds are quite local, though found at intervals for some miles on their strike along the north side of York river. Of these beds, which are associated with greyish sandstones, Sir William Logan remarks in Geology of Canada, 1863 : —

"Some beds of these rocks contain a peculiar resinous matter, which forms the cementing material. It appears on the fractured edges of the beds as in the form of irregular laminae, rarely an eighth of an inch in thickness, and generally much less. It has a vitreous lustre, a conchoidal fracture, and is tough, with a hardness nearly equal to calc-spar. Its colour is deep reddish-brown, but it gives a fawn-coloured powder, and when in thin plates or fragments, is translucent, and has an orange-red colour. This substance has neither taste nor odour, is insoluble in alcohol, naphtha, or potash-ley, and is but slightly attacked by nitric acid. It is scarcely fusible ; but at a high temperature is decomposed, with a slight softening and swelling, giving off abundance of inflammable vapours, and leaving a small quantity of brilliant spongy coke. It has the characters of a fossil resin, somewhat like amber, but approaches more nearly to what has been named scleretinite and middletonite.

"The portions of sandstone impregnated with this resin burn, when kindled, with a brilliant flame, and much smoke ; and the residue, which consists chiefly of siliceous sand, has very little coherence. Partial analysis was made of four fragments of this rock, which were supposed together to represent an average of the mass. The amount of volatile matter, of fixed carbon or coke, and of incombustible residue was as follows : —

	I	II	III	IV
Volatile matter	32.4	22.8	42.8	30.4
Carbon	8.9	8.1	7.4	8.9
Residue	58.7	69.1	49.8	60.7

"The purest specimen is seen to yield the smallest amount of fixed carbon. The excess of this in the others is due in part to the small portions of mineral charcoal generally present

among the layers of this resinous sandstone. This material could be made to furnish large quantities of illuminating and lubricating oils, by a process of distillation similar to that applied to coal and to bituminous shales. In some experiments made on a small scale to test its power of producing illuminating gas, it was found that a few pounds of this material, which lost, by distillation, 26 per cent of its weight, yielded two and a quarter feet of gas of superior illuminating power, to the pound. As this quantity of volatile matter corresponds to about 33 per cent of resin, it is evident that if obtained in a state of greater purity this material would become valuable as a substitute for coal in gasmaking.

"The specimens which served for the preceding experiments were obtained from a bed of from fourteen to fifteen inches thick, which was found near Shaw's mill, on the north side of Gaspé basin, and was traced by the overlying sandstones. In numerous localities along the York river, for a distance of nearly thirty miles, small interrupted beds of a similar nature are met with in the sandstones. Those observed had a thickness of from four to twelve inches, and are sometimes a hundred feet in length. Some of them are composed in great part of laminae of a brilliant brownish-black matter ; which when examined in thin fragments, show the same reddish translucency as the resin just described, and are apparently similar to it in composition ; although in some cases mingled with more coaly matter, and containing less ash. A specimen from one of these beds on the York river gave of volatile matters, 52.4 ; carbon, 26.3 ; residue, 21.3. The greater proportion of still more valuable hydro-carbons which may be obtained from this would render it still more valuable for distillation than the bed whose analysis has been given above."

"Another probable source of material for oil-distillation is found in the great development of the Utica shales, which occur along the course of the St. Lawrence from the vicinity of the city of Quebec, as at Montmorency falls, as far west as the city of Montreal. Between these places, especially nearing the latter

city, they occupy a large area along both sides of the river." (*)

In connection with the occurrence of Utica shales, it is interesting to note that quite a large development of these shales is found in the Lake St. John basin. This development occupies the parts of the townships of Metabetchouan, Charlevoix and Roberval which border on the lake, and it extends for ten miles, immediately west of St. Louis de Chambord. The "Ile de la Traverse" which is in the lake, off this strip of Utica shales, is also entirely composed of the same rock, showing that the bottom of this part of the lake is underlain by Utica shales.

In describing this development of shales, Mr. J. A. Dresser says that :— "the lower beds which are transitional, from the Trenton to the Utica, are in places alternately calcareous and ar- "gillaceous. The purely argillaceous beds immediately above "these appear to be more highly bituminous than the rest of the "formation. Some of these might be characterized as oil shales". (**)

BUILDING MATERIALS ***

A. O. Dufresne

A rather considerable decrease is noted in the production of the quarries of the Province. The value of the products extracted, from $12,054,857 for 1920 fell to $5,888,811 for 1921, a decrease of 18%. Notwithstanding this falling off, the production of the past year was greater than any year previous to 1920. During the first quarter it was generally understood that the year 1921 would be still more favourable to the stone industry

* Oil shales of New Brunswick and Nova-Scotia, by R. W. Ells, L. L. D., F. R. S. C., Department of Mines, Ottawa.

** Part of district of Lake St. John, Quebec, by J. A. Dresser, Memoir 92, Geological Survey, Dept. of Mines, Ottawa. 1916.—

*** Translated from the French.

than the previous year. In fact very active operations were carried on in certain lines of building materials during the early months of the year in anticipation of a greater demand for materials. But these expectations were disappointed and at the end of the year many operators had on hand large stocks of cement, bricks and crushed stone. Sand and limestone are the only ones on the list showing a greater quantity production than that of the preceding year.

The reports of the "Labour Gazette" published by the Federal Government give the statistics of the value of the building permits as issued in the six principal cities of the Province. This value is generally an indication of the activity of work in quarries ; but this year the relation between the figures is at variance. This may be partly attributed to the construction with artificial stones of two important buildings in Montreal : — the Mount Royal Hotel and the office building of the Canada Cement Co. In 1921 building permits were taken out for the amount of $28,403,240 which represents an increase of 24%. This is the highest value reached since 1914. It should be remarked that the great variation in the prices of material and labour do not permit of one judging of the quantity of work done for the above sum representing its value.

Sand and limestone each show an increased production in quantity of 50% and 2% respectively. All the other items show a considerable decrease : such as 90% for brick 25% for cement and 10% for lime.

The most prominent features of the brick industry in the Province for the year are the resumption of work at Saint-Tite de Champlain, by the "Industrielle de St-Tite, Limitée" ; the reorganization of the Granby brick-works under the name of "Granby Clay Products Ltd." ; the starting of operation of the plant of "La Compagnie de Tuyaux de Drainage, Limitée" at L'Islet, and the organizing of the "Metis Shale Brick Co. Ltd :" for the working of a deposit of vitrifying shales at St-Octave de Metis. The "Compagnie de Tuyaux de Drainage" at L'Islet began to produ-

ce on the fifteenth of May 1921. The plant is located west of the station at L'Islet on the Canadian National Railways. A deposit of clay is being worked which is described as follows by Mr. Jos. Keele, the ceramic engineer of the Federal Mines Department :

"The clay of this locality as seen in the pit worked by La Cie de Brique de L'Islet, differs from any deposit so far examined in the province.

"The bottom clay is a highly plastic, tough, fine-grained reddish clay, without jointing or bedding. The stones imbedded in it are small round boulders, probably dropped from floating ice, but there do not appear to be any gravel pockets or layers, such as generally occur in clays under such circumstances. The upper surface of this deposit is uneven ; it appears to have been eroded before the deposition of the upper stratified clay.

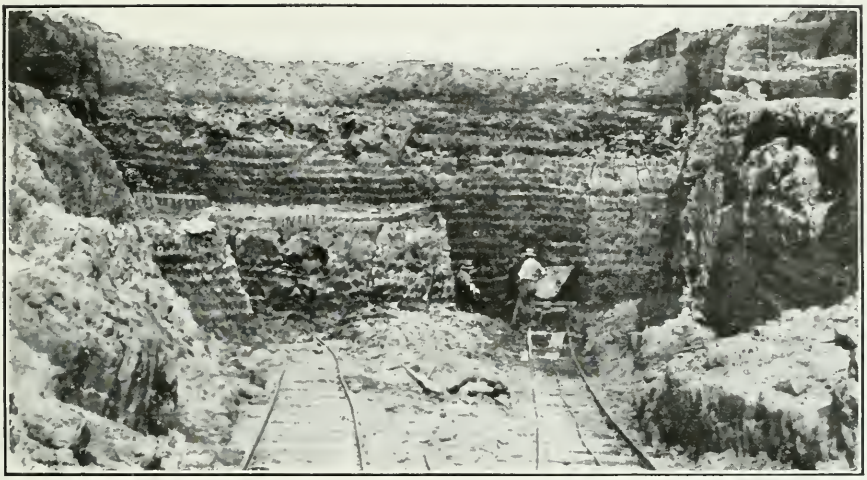
"The upper deposit contains sand and silty layers interstratified with clay, and a few scattered pebbles. It resembles a flood-plain deposit. The upper two or three feet is weathered to a brownish colour while the lower part is bluish gray.

"The whole of the bank is used for brick making, the different clays being mixed in the proportion in which they occur. The larger stones are separated out by hand picking and no sand is added.

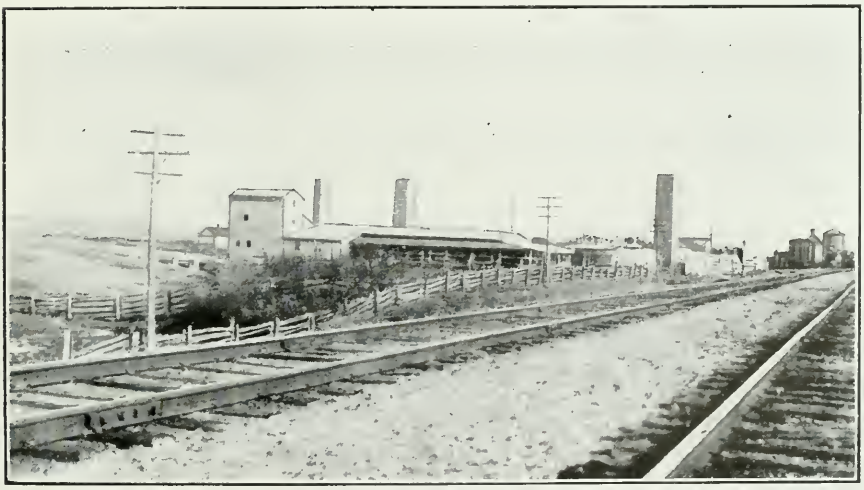
"If it were free from pebbles this would be one of the best brick clays of the province. It burns to a hard, red body with a good ring when struck, at cone 010, the shrinkage and absorption being low. If burned to cone 06 or higher, in down draft kilns, the brick could be used for sewer linings or underground work.

"The clay when ground works smoothly through a die and makes an almost perfect round tile, which is sound and strong when hard burned."

In the pit the clay is cut with shovels and loaded into cars. The latter are dumped near the mill where the clay is



La Compagnie de Tuyaux de Drainage, Ltee.— Clay pit at L'Islet Station showing method of working



La Cie de Tuyaux de Drainage, Ltee.— General view of the plant at L'Islet Station

spread under shelters made of boards for drying. This clay which is dried in the open air is afterwards mixed with the clay coming directly from the pit and is conveyed to the mill where it passes through a grinder to break the small stones it contains, then to a pug mill where it is kneaded. The outlet of this machine is provided with a die which produces a ribbon of the shape and dimensions required. Thus one obtains either a cylinder in the case of drains or a rectangle when making hollow bricks. Immediately after coming out of the die the ribbon is divided transversely by small steel wires moving mechanically. The green bricks and green pipes are then placed on drying cars which are wheeled into the dryer. The latter consists of six long parallel galleries four feet in width six feet in height and one hundred feet in length and each chamber is provided with a fire box. The bricks remain 24 hours in the dryer. The burning is done in two round down draft kilns of an inner diameter of twenty-eight feet. These kilns can hold twenty-eight thousand tiles of 4 inches or twenty-two thousand hollow bricks 4 inches by 8 inches by 12 inches ; or a hundred-thousand building bricks. The kilns are fired with bituminous coal and the burning lasts 62 hours.

Previous to 1915 there was no knowledge in the Province of any deposit of clay or shales which could be used for making vitrified products. Mr. Jos. Keele, the ceramic-engineer of the Federal Mines Department, after a careful study ascertained the possibility of using for this purpose the Levis shales which outcrop at St. Joseph de Levis and those of the Sillery formation found south of the Boyer river near St. Charles de Bellechasse. (1)

Since then Mr. Keele has made tests on samples coming from the seigniory of Lepage-Thibierge, in the County of Matane where rather considerable deposits of vitrifying materials are found.

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(1) Geological Survey of Canada, Memoir 84.—Preliminary report on the clay and shale deposits of the province of Quebec, by J. Keele, 1916.

The result of one of these tests is described on page 58 of the Summary Report of the Mines Branch of the Federal Department of Mines for the year 1920. These samples submitted by Mr. Arthur L. Landry, came from lots 76 to 82 of the South-east range of the Metis river. These shales possess slight plasticity but sufficient to pass through the die-plate of brick making machines. The drying is effected rapidly without cracks and the shrinkage during the drying is slight.

"The red shale burns to a dark of brownish-red colour, and the grey shale to a light brilliant red. The bricks made from this shale are hard and dense when burned to a temperature of 2000 degrees Farenheit (cone 03), and are not quite vitrified. These shales will stand a higher temperature without softening, so that they may safely be used for the manufacture of paving blocks or other vitrified products.

"Both shales begin to soften at cone 7 (2318° Fah) and are not quite fused at cone 9 (2390°), so that they are true vitrifying shales, a type comparatively rare in this region."

So far the existence of three deposits of red vitrifying shale is known in the seigniory of Lepage-Thibierge. They belong to the unaltered bands of the Sillery formation. The first is on lots 109 to 118 of range IV of the parish of St. Joseph-de-Lepage ; the second on lots 76 to 82 of the South-east range of Métis river and runs across lots 31 to 33 on the North-east range in the parish of St. Octave-de-Métis ; the third comprises lots 160 to 162 of the range V of the parish of St. Joseph. These outcrops are at a distance of five, six and three miles respectively from the station of Mont-Joli on the Canadian National Railways. This station is 198 miles east of Quebec and 360 miles east of Montreal.

The clay working industry takes an important place among the manufacturing industries of the Province. Besides the products manufactured from local clays other articles are made from clays imported from the state of New Jersey. Amongst these are refractory wares including stove linings, arch bricks and

special shapes ; sewer pipes ; and sanitary pottery. The pottery industry in this Province is rather an important one. The principal center of production is at St-John's. From figures given to the Bureau of Mines, the value of clay products made of imported clays amounted to $508,034 for the year 1921. The industry employed 161 hands which received $191,811 in wages.

In the table of mineral production it will be noted that the value of the production of slate has more than trebled in 1921. This substantial increase must be attributed entirely to the new use made of this product. Nearly the whole of this production represents the sale of granulated slate for the preparation of composite paper for roofing. The manufacturers prepare this product by depositing a layer of broken slate on a paper strongly impregnated with bitumen or asphalt. The manufacturers of roofing paper chiefly look for slate of bright colour. The red or green slates of Cambrian age fully meet this requirement.

The demand for the granulated product created new interest in this industry and during the year several companies were formed for the exploitation of the deposits already known. These are : The British Canadian Marble Co., Ltd. ; Canada Slate Corporation ; Slate Products Co. of Canada, Ltd, and the Mystic Slate Co., Limited.

The *British Canadian Marble Co. Ltd.* which works a bed of red marble near the Calway river on lots 422, 423 and 424 of the first southeast range of St. Joseph de Beauce has found in contact with the marble, a band of bright red slate. The development work consists in a mine-shaft 5 feet by 10, and 70 feet deep in the band of slate. Sixty feet from the surface five cross-cuts have been driven. One runs towards the east over a length of 100 feet ; the second 70 feet long runs towards the south and the three others in the westerly direction for a distance of 80 feet, 75 feet and 75 feet respectively. The south cross-cut reaches a schistose porphyry of a green colour. A crushing mill was built during the autumn of 1920. This building measures 41 feet by 56 and shelters the necessary plant for crushing and screening. The operations comprise crushing with a Champion crusher, 9

by 15 inches opening ; after which the stone is hoisted into a bin ; then it passes on to a shaking table which acts as a dryer, to a large Jenckes rolls, 30 by 20 inches, afterwards to two vibrating screens and then a second set of Jencks rolls, 20 by 18 inches. The last operation consists in fine crushing in a King Bee Chopping Mill No. 4, after which the material goes to a 300 ton bin. Two electric motors of 20 and 75 h. p. supply the power.

The *Canada Slate Corporation* began in the month of January 1921 to build a crushing plant on lots 238 and 239 in the parish of St. Anselme de Dorchester. The building measures 24 feet by 48 and is 42 feet high. The first crushing is done in a Sayer & Massie crusher, 15 by 18 inches. A bucket elevator hoists the crushed material to a revolving screen 8 feet in length by 30 inches in diameter ; the stone then passes through a set of rolls, then into a second revolving screen. An apparatus removes the dust by suction by means of a 15 in. Keith fan. A siding of 350 feet brings the railway cars under the storage hopper. The mill is driven by an 125 h. p. electric motor. The power is supplied by a local company who have developed a small water fall on the Etchemin river. At the end of the year 1921 this company had not yet begun producing. Its intention is to work on a large deposit of schistose slates of the Sillery formation which outcrop on these lots. These slates consist of red bands separated by small green threads hardened by dynamometamorphism. Development work consists in a trench 150 feet long and a working face at right angle to this 25 feet long and 12 feet high.

The *Slate Products Co. of Canada Ltd.* works a deposit of green slate on lot 14 of range IV in the township of Melbourne. The company has built a crushing plant with a capacity of between 15 and 20 tons per 10 hours. The machinery consists of a Champion No 5. crusher, bucket elevator, bins, crushing rolls, a revolving screen. The merchantable product passes through a screen of 10 mesh and stays on 48 mesh.

In the month of November a fourth company was incorporated in Quebec under the name of the *Mystic Slate Company*

Ltd. This company intends to work a slate deposit near Mystic in the county of Missisquoi.

The quarrying of roofing slate was discontinued in the month of May at the quarry of the New Rockland Slate Company, in the township of Melbourne.

During the year 1921 three new companies were organized for working granite quarries. One *"La Compagnie de granit de Charlesbourg, Limitée"* has, since the 1st of May, been working on a deposit of granite, on lot 640 of St. Pierre de Charlesbourg near Quebec ; another as *"La Carrière Bussière Limitée"* has bought all the properties of the Megantic Stanstead Quarries Co. Ltd. and during the course of the year worked the Bussière quarry on lots 10 and 11 of range IX of Gayhurst, on the west side of the Morne. A portion of the stone taken from this quarry was used in the building of the church of "Les Pères du St. Sacrement" on the St. Foy road Quebec. The third, Messrs Jobin & Genois of Quebec who opened a quarry at Rivière-à-Pierre on lot 3 of range I of the township of Bois, also supplied granite for that church.

In the following pages will be found a short review of the importance and of the geographical distribution of building materials in the Province of Quebec.

Building Materials in the Province of Quebec

In the Province of Quebec quarrying is closely connected to some extent with the improvement of urban roads but above all with the development of the building industry. The exportation of construction materials or ornamental stones which in certain countries is a great support of quarrying is almost unknown in our Province. Barely a few tons of granite from Stanstead and marble from Missisquoi are shipped to other provinces of the Dominion.

There have been in the quarrying industry periods of activity and also periods of comparative quiet. This may be seen by the tables of statistics showing the importance of its production.

In 1909 the value of quarry products was estimated to be $2,898,118. During the four following years this value increased considerably and in 1913 it reached $8,186,917. The effects of the great world war which raged from 1914 to 1918, were felt even in the development in our cities. It was a regressive period for the quarries and in the last year of the war, 1918, the production did not exceed $5,340,987. But a stoppage of five years in building, notwithstanding the increase of the urban population, was soon to bring about a scarcity of lodgings and consequently a renewal of activity in building. The price of materials rose with the demands so that in 1920 the products of the quarries amounted to $12,054,857.

To better show the close relation between the production of the quarries and building in the Province of Quebec hereafter are given figures of the statistics in connection with the latter. The erection of buildings had its period of development before the war. The maximum value of building permits for the five principal cities and towns of the Province, was reached in 1913. That year the value of building rose to $34,893,449. The world war stopped the progress of the building in the district of Montreal as well as all over the country. In 1918 the estimated cost of buildings was only $6,852,334. Since then there has been a recovery especially in connection with the building of houses and in 1920 it was carried on to an amount of $21,660,492 in the five principal cities of Quebec and for $41,467,777 in the whole of the Province.

The statistics of production show the importance of the latter industry but in order to fully know the intensity of the work in the quarries it is necessary to refer to labour statistics. The figures given here are those of the number of men reduced to a basis of 300 working days per annum ; that is every man working 300 days is a one year-man, as two men who worked 150 days or three men who worked 100 days.

In 1913 the quarries of the Province employed the greatest number of men, 5100. This number decreased regularly until the end of the war ; in 1918 there were not more than 1013. But

during the two following years activity increased and the number of workmen was doubled. These figures are a good index of the work in the quarries. They are the more accurate, for the operating methods have varied but slightly although there is a tendency to replace work by hand by that of machinery.

A careful examination of the table showing the value of the quarry products, the number of men employed and the estimated cost of building permits will show that the cycles for each are of the same duration, that they attain a maximum the same year and simultaneously touch the minimum point. The table clearly shows the influence of the building industry on quarry operations.

The operations of the quarries in the Province therefore depend on the activity in the building industry. There was a period of inactivity during the war. The resumption of activity is necessary to lodge the increase of population noted in the cities ; it is necessary to provide for the increase of immigration.

When the period of uncertainty has passed away and optimism once more prevails in industrial centres the old industries will extend their operations ; new factories will manufacture to a more finished degree the natural products which hitherto have been exported raw. It will be necessary to have labour for erecting these buildings and for driving machinery. All this population will have to be lodged. A great quantity of building materials will be wanted for factories, for dwellings and for completing municipal works. There is no exageration in saying that we shall soon see in our quarries the same intense activity that reigned in 1911-13.

In view of this development and to encourage builders to seek in the Province the materials they will need, the following review has been prepared in a concise form. Many of the details of economic importance have had to be left out. The Province of Quebec can produce all the varieties of buildings and ornamental stones that it may need. It is not necessary to seek for imported

articles or artificial materials. The slate quarries, clay pits, sandstone, granite, marble, limestone quarries, lime kilns and cement factories can supply all the necessary materials for building houses, factories and edifices suitable for commerce and finance.

TABLE OF STATISTICS FOR QUARRIES FROM 1909 TO 1921, WITH OPPOSITE THE VALUE OF NEW BUILDINGS IN THE PROVINCE OF QUEBEC

Year	Production of Quarries	Number of 300-day workers	Estimated cost of building permits "Labour Gazette"	Cost of new buildings "Provincial Statistics"
1909	$ 2,898,118	.....	.....	.....
1910	4,304,764	.....	$ 21,378,827	.....
1911	5,238,332	.....	20,998,391	.....
1912	7,196,154	4,481	26,688,493	.....
1913	8,186,917	5,100	34,893,249	.....
1914	7,799,294	3,898	24,527,591	$ 23,950,502
1915	6,242,234	2,784	12,267,849	10,611,921
1916	5,278,406	2,574	9,890,630	16,840,451
1917	5,447,089	1,893	8,794,149	14,170,654
1918	5,340,987	1,613	6,852,354	9,649,341
1919	8,090,241	2,406	15,166,851	23,433,285
1920	12,054,857	3,124	21,660,492	41,467,777
1921	9,988,811	2,458	28,403,240	.....

LIMESTONE

The working of the limestone beds in the Province of Quebec is an important industry. In 1920 the production rose to nearly a million tons the value of which at the quarry amounted to the sum of $1,584,316. The year of the greatest production was 1913 when the sale of limestone amounted to $1,704,207. As may be seen by the table below, from 1910 to 1913 the value of the stone extracted was quadrupled : from $457,143 it rose to $1,704,207. During the following years the quarries felt the effects of the years of the war. It 1918 the value of the production was only $666,046. Since then there has been a tendency

to a rise and it is expected that building operations will be accompanied by operations on a large scale in the quarries.

Broken stone is used in building with concrete which has been so much in favour in late years ; before this kind of building came into use a great quantity of limestone in the shape of dimension blocks was used in building houses and edifices. The operators sold rough stone for the foundations and they cut dimension stones for outer walls. Stone dressing gave work to a great many workmen ; at present the stone-cutters work has a tendency to disappear. The introduction of mechanical methods for cutting : such as the use of lathes and other machine tools, has reduced the number of workmen in the quarries.

Cut stone was in great favour as stone for house building until the end of the last century. Since 1900 the architects prefer to use brick of good quality for exterior surface and common brick for filling in, while they recommend concrete for foundation.

The construction of great highways throughout the Province as well as rock ballasting of railway tracks and the paving of roads in the cities absorb considerable quantities of materials. They call for a good proportion of the crushed stone. For these many quarries were able to continue operations during the period of depression caused by the war. The importance assumed by the broken stone industry cannot be better illustrated than by statistics. During the year 1920 the quarries in the Province sold 839,607 tons of crushed stone representing a value of $1,086,819, say the two-thirds of the value of all the limestone extracted.

There are many buildings constructed of limestone in the cities and towns in the province of Quebec ; but Montreal is above all the place where most of such stone has been used. Besides the majority of residences and many commercial and public buildings, the principal churches and chapels have been built of the local limestone. The first operations on limestone beds in the city of Montreal are now a part of its history. As

Montreal lengthened its streets, the first quarries were surrounded by dwellings and their quarrymen had to go further away to find beds on which they could operate. The old quarries have since been filled up and the land subdivided into building-lots. The development of the city while enriching the operators compelled them to transfer their workings beyond the city limits. Operations have been carried on in the Mile-End quarries for more than a century. They are associated with all our historical edifices. The stone used in the important buildings came from this group of quarries situated on each side of the road to Bélair tanneries, now better known as the "Chemin des carrières" which runs from Henri-Julien street near Mont Royal street to the road of the Petite Cote-de-la-Visitation. The stone used in 1824 for the building of Notre-Dame church in Montreal, one the finest religious monuments in the metropolis, came from these quarries.

The first reports of the Geological Survey mention that about 1850 work was being carried on in quarries near the Mile-End toll gate on the road leading to Sault au Recollet. Ten years ago, Delorimier street ended at a group of quarries situate on the Lionais property a little above Mont Royal street. To the east of the city, several quarries were worked in the vicinity of Nicolet street.

At present the chief groups of quarries which are being worked on the island of Montreal are the Villeray on Rosaire street ; the Papineau on Bellechasse street ; the Rosemont on Iberville and Masson streets and Rosemont Boulevard. There are others of minor importance in the new wards as at Cartierville near the terminus of the tramways ; at Bordeaux around the jail ; to the east in Longue-Pointe ward ; and outside the present city limits, in the municipality of Pointe-aux-Trembles to the height of the prolongation of Sherbrooke street ; and at St. Laurent behind the college.

At Pointe Claire there is a quarry now abandoned near the Golf Club house from which was taken the dimension stone for the piers of the west part of the Victoria bridge. The stone

from this quarry has also been used by the Grand Trunk Ry for building the piers of other bridges along its road.

The limestone worked in the province of Quebec is generally of Ordovician age : the beds lie horizontally and they are connected by their fossils with the Chazy and Trenton formations. The rocks of this period underlie that part of the valley of the St-Lawrence comprised in the triangle whereof Quebec, Hull and Missisquoi are the summits.

To the east of Quebec on the north shore, there are many thin patches of limestone in several places : among others at Pointe aux Esquimaux, at Mingan Island, on the northern slope of the island of Anticosti, at Malbaie, at Baie St. Paul and at Chateau Richer. A portion of the southern shores of Lake St. John in underlain by limestone of the Trenton formation and at Chambord stone is shipped to the chemical pulp mill at Kenogami. From Montmorency to Charlesbourg passing by Beauport, the cliffs of old Quebec, on the North shore of the Island of Orleans, patches of the Trenton formation are found. The great development of the limestone beds of Ordovician age, begin at the St. Lawrence river at Neuville. The band, several miles wide follows the foot of the laurentian plateau running in the southwesterly direction. At Joliette it widens and bends towards the south, so as to cover Ile Jésus and Montreal island, then it crosses the St. Lawrence and extends into the counties of Laprairie, Napierreville and St. Johns as far as Rouses Point. Geological observations reveal the existence of patches of Trenton limestone west of Montreal at Grenville, Hull, Quyon and at Ile aux Allumettes in the county of Pontiac. East of the Richelieu river large areas are known to be underlain by limestone. It is classified as Trenton by those geologists who have studied its characteristics. All these bands are paralled to the axis of the Sutton chain of mountains. The first starts from Missisquoi Bay and runs in the north-easterly direction passing through Farnham, St. Hyacinthe and Drummondville. The second band joins in the south with the former, passing through the east of Granby and running towards South Durham, whence the

band widens so as to cover a part of the townships of Durham, Wickham, Kingsey, Simpson and Warwick. Patches are also found in the townships of Stukely and Ely ; in the townships of Melbourne, Cleveland and Shipton ; in the basin of lake Memphremagog ; in the township of Stoke ; and the townships of Dudswell, Weedon and beyond as far as the shore of lake Aylmer. Throughout the whole development of rocks classified as of the Cambro-Silurian period which begins at the boundary in the county of Stanstead, and runs towards the east, crossing the Chaudière river at its headwaters continuing along the Maine boundary to beyond the township of Estcourt in Témiscouata, one finds chiefly slate and sandstone, containing large lenticular masses of limestone.

Silurian limestones are found on the east shore of lake Témiscouata, in the basin of the lake and valley of the Matapedia and also at Port Daniel.

At Burnt island in lake Témiscamingue, from limestone strata belonging to the Niagara formation, stone was obtained for building the Anglican church at Haileybury, in Ontario.

At Gaspé Point there is limestone of the Devonian period to which the name of Grande Grève formation has been given.

Limestone is chiefly used for building purposes, but it is also of great use in the chemical industry. The Canada Carbide Co. uses the very pure Stanbridge limestone at its plant at Shawinigan. The factories which manufacture paper-pulp by the tower process, such as those of Kenogami and Grand'Mère, use limestone for chemical reactions. It is used in the refining of sugar. At St. Marc-des-Carrières, the Deschambault Quarry Co. pulverizes limestone which it sells to farmers to improve their farms. At Dudswell the Dominion Lime Co. crushes limestone to make poultry grit. The Montreal Crushed Stone, Limited sells to the farmers the dust coming from its crushing plant at St. Vincent de Paul.

The limestone obtained in the Province furnishes the best quality of building materials. It has been used in erecting a

number of edifices almost everywhere in the Province ; amongst others the stone from the Mile-End quarries has been used in the building of the Notre-Dame church in Montreal ; from the Martineau quarries on Garnier street the stone required for the parish church of St. Edouard was obtained. The St. Dominique quarry furnished the stone for building the post office and City Hall at St. Hyacinthe ; while the School of Higher Commercial Studies, Viger avenue Montreal, the post office, the library of the Province Parliament and the city hall of Quebec, are built of limestone from St. Marc-des-Carrières. The rear part of Laval University and St. Peter's Anglican church in Quebec were built with Chateau Richer limestone. For the building of the churches of Sayabec and Val-Brillant, Silurian limestone from the seigniory of Matapedia was used.

Quarries in which operations are carried on are to be found nearly almost everywhere in the Province of Quebec. The eastern most ones are those of Port Daniel on the Baie des Chaleurs and of Val-Brillant in the seigniory of Lake Matapedia ; to the north is that of Chambord at Lake St. John ; in the neighborhood of Québec the chief centres are Château Richer, Beauport, Grondines and St-Marc-des-Carrières. For Three Rivers the stone is obtained in the parish of St. Louis de France ; then in the direction of Montreal are found quarries at work at St. Cuthbert and Joliette ; on the Ile Jésus at St-François-de-Sales, St-Vincent de Paul and Cap St-Martin ; on the island of Montreal the most important quarries are grouped at Villeray, Rosemont and Pointe aux Trembles ; in the immediate vicinity of Hull work is being done in large quarries for the needs of that region ; on the south side of the river St. Lawrence the chief operating centres are those of Caughnawaga, Beauharnois, Valleyfield, St. Dominique near St. Hyacinthe, of Acadie and of Grand Ligne near St. John's, of Stanbridge in the county of Missisquoi and of Dudswell in the county of Wolfe.

TABLE OF STATISTICS FOR LIMESTONE QUARRIES

Year	Quantity in tons	Value in dollars	Number of 300-day workers
1909	.....	$ 457,243	.....
1910	.....	1,503,173	.....
1911	.....	1,128,402	.....
1912	.....	1,363,555	.....
1913	.....	1,704,207	.....
1914	.....	1,646,965	1,229
1915	.....	1,702,937	1,426
1916	.....	869,136	775
1917	.....	693,772	504
1918	.....	666,046	428
1919	708,172	916,776	556
1920	988,209	1,584,316	777
1921	1,007,733	1,523,027	799

MARBLE

Marble is a variety of limestone grouped apart for its special qualities. It is distinguished from the ordinary limestone by its colour and by its recrystallization. It is used as a building stone ; but much more as an ornamental stone.

Doctor William A. Park, in Volume III of his "Report on the Building and ornamental Stones of Canada", divides the Quebec marble into two groups (a) those belonging to the Precambrian era ; (b) those of the Paleozoic era.

The Pre-cambrian marbles are found chiefly as metamorphic beds in the laurentian plateau principally in the counties of Pontiac, Hull and Champlain, and in the Eastern Townships where marble outcrops in the denuded anticlinal folds of the appalachian mountains as in the county of Shefford.

The Pontiac marble is quarried mostly at Portage du Fort. It is a white coarse-grain marble very suitable for exterior de-

coration. It has been used in building the Bryson court house and many residences in the vicinity.

At Ste-Thècle attempts have been made to work an important band of white and salmon-pink marble. Unfortunately its commercial value is greatly decreased by the coarseness of its grain and by the many inclusions of dark rocks which it contains. The existence of bands of crystalline limestone in various parts of the laurentian plateau is known, especially in the counties of Hull, Labelle, Argenteuil, Terrebonne, Joliette, Montcalm, Berthier, St. Maurice, Montmorency, Chicoutimi and Saguenay.

At South-Stukely operations were carried on for some years on a quarry which gives marbles of pale and deep shades of yellow, pink and violet colours. The Château Laurier and the Union Bank at Ottawa, the Ottawa Bank at Regina, the offices of the Canadian Pacific Railway in Toronto, the Standard and Builders Exchange buildings in Montreal are decorated with stones from this quarry. The church at North-Stukely was built of marble from that locality.

Paleozoic marbles are found in the counties of Terrebonne, Missisquoi, Wolfe, Beauce and Bonaventure. In the vicinity of Philipsburg, on Missisquoi Bay, there is an area of metamorphic limestones of the Ordovician period. The marble known in the trade under the name of "Missisquoi" is taken from these strata. Slabs of a fine mottled grey, with irregular bands of milk white or greenish grey colours are obtained. Others are of large rose coloured clouds distributed irregularly in a matrix of dark green. This marble was used for decorating the interior of many edifices in the commercial section of Montreal ; among others : the Transportation, the Gillett and the Windsor Station buildings. This marble is greatly sought for and builders have used it in a good many buildings of several cities throughout the Dominion.

There are also other deposits on which operations are not carried on and from which bluish grey marbles as at Dudswell or of dark red, as at St. Joseph de Beauce can be obtained.

TABLE OF STATISTICS FOR MARBLE QUARRIES

Year	Number of Men	Value in Dollars
1909	125	$ 130,000
1910	155	151,103
1911	170	143,457
1912	282	252,041
1913	209	120,541
1914	90	98,890
1915	85	127,204
1916	85	118,809
1917	50	55,820
1918	...	.....
1919	118	192,489
1920	127	228,353
1921	92	167,664

LIME

Lime is the product of the calcination of limestone. It can be made wherever that stone is met. In many parts of the Province limestone was burnt as the needs of the region required. Most of these lime-kilns are now extinct : the burning of lime is done but at very few places and the small intermittent wood burning kilns are replaced by modern kilns fired with coal or by producer-gas. The distance from the places where fire wood could be obtained ; the intermittence of the operations ; the exactions of the workmen ; the difficulties of transport where these kilns were not near the railways are the principal reasons for the disuse of the old lime-kilns.

Places where lime has been burnt are very numerous. The

best known are those of Dufaultville, county of Matane ; Beauport near Quebec ; Pont Rouge, St. Casimir and St. Marc-des-Carrières in the county of Portneuf ; St. Cuthbert of Berthier ; La Chaloupe, St. Come and Ste. Angelique de Joliette ; Rawdon in the county of Montcalm ; Ste. Jovite de Terrebonne ; St. Vincent de Paul, of Laval ; on the island of Montreal ; Magoon Point in the county of Stanstead ; Ste. Anne dé Stukely ; Philipsburg and Stanbridge in the county of Missisquoi ; and on Burnt Island in Lake Témiscamingue. In 1900 Mr. Obalski, in his yearly report on the mining operations of the Province, estimated at 200 the number of lime-kilns in operations and at 350 the number of workmen engaged in the industry. He valued the annual production at one million bushels.

At present calcining is still being done in several of the old lime kilns of Caldwell and Bryson in the county of Pontiac ; at Hull and Kazubazua in the county of Hull ; at Ste. Thérèse de Terrebonne ; on Cadieux, Poupart, Prénoveau and Delorimier streets at Montreal ; at Joliette ; at St. Louis de Champlain ; and at St. Dominique in the county of St. Hyacinthe.

The modern kilns now working are those of the Standard Lime Co. Ltd at Joliette and St. Marc-des-Carrières, the Dominion Lime Co. at Dudswell and those of the St. Maurice Lime Co. near Three Rivers.

It is difficult to find exact figures of the production of lime from 1900 to 1910. From the figures given by the Quebec Bureau of Mines, it would appear that the yearly production at the end of that decade would not show more than 15% increase as compared with the beginning of that period. During the three following years considerable progress was made, and in 1913 the production amounted to 1,922,837 bushels. The stoppage in building caused a falling off in operations and the smaller operators had to extinguish their fires. In 1915 the production dropped to 1,209,695 bushels. Nevertheless this decrease is proportionally smaller than that of bricks and limestone ; for, apart from building, lime is used for a great many industrial

purposes. It is used for a great many things and chiefly in making chemical wood-pulp. The chemical pulp-mills bought in 1919 $400,000 worth of calcareous substances whereof probably eighty per cent represented the purchase of lime. The most important year in the lime industry was that of 1919 when the sale was 2,124,878 bushels of the total value of $521,031.

A considerable part of the lime produced is used in the building industry as for making mortar for outside walls, and for plastering the inner walls. A single company, the Standard Lime Co. Limited at its Joliette establishment produces mechanically hydrated lime. The chemical industry is now the most important customer of the lime kilns. Lime is used in the making of glass, pottery and porcelaine ; for purifying drinking water ; in the preparation of caustic soda and bleaching powders ; in the making of calcium carbide ; in the manufacture of lighting gas, the gas coming from the distilling of coal is passed through a solution of milk of lime to free it

TABLE OF STATISTICS SHOWING ANNUAL PRODUCTION OF LIME

Year	Quantity in Bushels	Value in dollars	Number of 300-day workers
1909	.....	$ 105,489	...
1910	1,152,321	279,306	....
1911	1,284,914	284,334	....
1912	1,705,937	455,579	...
1913	1,922,837	464,424	....
1914	1,680,977	391,622	238
1915	1,209,695	228,670	149
1916	1,267,590	276,245	177
1917	1,500,728	343,588	139
1918	1,607,708	438,673	145
1919	2,124,898	521,031	196
1920	1,809,039	682,477	198
1921	1,664,242	624,574	131

from impurities ; in agriculture lime is used to improve the soil and to destroy injurious insects ; paints and washes are made from it ; it is used in the preparation of glycerine and soap ; in the tanning of leather etc. But its most important use is in the transformation of wood into pulp for paper by chemical processes.

CEMENT

In the building industry what is called cement is the result of the calcining of certain clayey limestones or a mixture of limestone and clay. This product hardens when water is added and when mixed with sand and broken stone forms what is known as concrete.

There are two kinds of cement : the natural and the Portland. The limestones from which natural cement is made contains from 15 to 35% of clay and a small quantity of alkali.

The Portland cements are artificial products. They are made by mixing a definite proportion of limestone, clay and alkali.

Little information is to be found in the official reports on the manufacture of natural cements in the Province of Quebec. William A. Logan in his "Geology of Canada" (1), published in 1863, describes certain localities where a stone suited for the manufacture of cement was found. Mention is made of the black limestone of Quebec calcined and pulverized by Mr. Gauvreau. In the reports for the year 1890 of the Geological Survey of Canada (2), will be found a list of the manufacturers of hydraulic cement, among which figures the name of T. A. Gauvreau & Co. of Quebec.

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(1) G. S. C.—Geology of Canada, 1863, P. 854.

(2) G. S. C.—Annual Report, New Series, Vol. V, p. 190, S.—

Mr. Obalski, in his report on "Mines and Minerals of the Province of Quebec" (1), mentions that a cement known in the trade as Gauvreau cement was made in Quebec. In the report of the Geological Survey of Canada for the year 1871-72 (2), there is a table in which appears the name of the Orleans Cement Works, manufacturing hydraulic cement at St. Pierre on the Island of Orleans. The mill had turned out 300 barrels yearly. At Hull the C. B. Wright & Co. also manufactured hydraulic cement in 1890. This mill was destroyed by fire in 1900.

The report on the mining operations of the Province of Quebec for the year 1900, mentions that, at lake Weedon on the Quebec Central Railway, the Canada Lime and Cement Co. built a mill for manufacturing a kind of cement comparable to the Portland one, and the company reported that a small quantity of the product had been shipped in the previous year.

Although the manufacture of Portland cement dates from 1890, it is really only since 1905 that the industry began to develop, to eventually arrive at the culminating point it reached in 1920. The first Portland cement factory in Canada was built in 1890 at Pointe-Claire near Montreal, by the Imperial Portland Cement Co. Ltd. which does not seem to have operated very long. In the following year a second mill was built at Marlbank Ontario (3).

About 1896, Mr. Th. M. Morgan organized the Crescent Cement Works and built a mill at Longue Pointe, east of Montreal. This mill was destroyed by fire in 1901 and rebuilt shortly afterwards. Its maximum annual capacity was about 20,000 barrels. Mr. Morgan's establishment was enlarged in the following year. In 1906 he sold out to the firm of Forwick & Co. of

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(1) Quebec Bureau of Mines — Mines & Minerals, J. Obalski, P. 147.

(2) G. S. C.—Report of Progress for 1871-72. P. 148.

(3) G. S. C.—Annual report, N. Series. Vol V, P. 190 S.

New York. The latter built a large plant of a capacity of 2,000 barrels a day, and in 1907 it in turn sold the whole to the Vulcan Portland Cement Co. Ltd.

In 1902 the International Portland Cement Co. after carrying out a series of borings near the Ottawa river at Hull, built a large establishment for the manufacturing of Portland cement. This mill was built for a daily capacity of 2,500 barrels.

The Lakefield Portland Cement Co. began the building of a cement mill in 1906 at Pointe aux Trembles near Montreal. This establishment, the most up to date then existing in Canada, began to manufacture in January 1908 with a possible yield of 2,000 barrels a day.

The year 1909 marked a salient period for the cement industry in the Province of Quebec. During that year the three large cement companies : the Vulcan Portland Cement Co., the International Portland Cement Co. Ltd., the Lakefield Portland Cement Company, as well as several others in the provinces of Ontario and Alberta were amalgamated under the name of the Canada Cement Company, Ltd.

The table of the production of cement in the Province is very interesting. The first cement used was the natural cement. About 1899 the era of synthetic or Portland cement began. The latter increased in favour as people learned how to use it ; whereas the natural cement saw its production decrease and become null about 1900 in the Province of Quebec and in 1909 throughout Canada (1).

The manufacturing of Portland cement remained stationary until 1904. It was then sold at $1.69 per barrel of 350 pounds. This was the period of small undertakings. After that year the construction of the large mills of Hull, Longue-Pointe and of Pointe aux Trembles began. The demand for the product grew considerably and the production also increased greatly. The

(1) Mines Branch Memoir No. 88, P. 249, Ottawa.

annual production in the Province of Quebec which was only 33,000 barrels in 1904 rose to a million barrels in 1909. The price that year was $1.30 per barrel. Production on a large scale enabled a reduction in prices of 23%. During this time the imports which had quadrupled from 1898 to 1905, diminished in the same proportion . After 1909 came the period of the amalgamation of the companies. The mills were enlarged, economies were realized in the manufacturing, the output of the machinery was increased ; the administration was placed on a scientific basis and a drop in prices ensued. A minimum of $1.13 per barrel

TABLE OF STATISTICS SHOWING ANNUAL PRODUCTION OF CEMENT IN THE PROVINCE OF QUEBEC

Year	Quantity in barrels	Value in dollars	Price per barrel in dollars
1900	22,700	$ 36,570	$ 1.65
1901	17,000	28,000	1.64
1902	36,000	61,000	1.69
1903	40,000	66,000	1.65
1904	33,500	50,250	1.50
1905	254,833	408,000	1.60
1906	405,103	625,570	1.54
1907	.....	640,000	....
1908	810,695	1,127,335	1.39
1909	1,011,194	1,314,551	1.30
1910	1,563,719	1,954,646	1.25
1911	1,588,283	1,931,183	1.21
1912	2,684,002	3,098,350	1.15
1913	2,881,480	3,361,292	1.16
1914	2,840,436	3,325,055	1.17
1915	2,484,362	2,805,374	1.13
1916	2,150,457	2,525,841	1.17
1917	2,079,404	3,264,664	1.57
1918	1,564,341	3,003,534	1.92
1919	2,259,152	4,337,572	1.92
1920	3,013,463	6,545,053	2.17
1921	2,135,631	5,410,276	2.53

was reached in 1915. Then followed the high cost of raw materials, explosives, labour and, above all, of coal, so that in 1921 the selling price was equal to double that of 1915.

The manufacturing of cement is one of the important industries of the Province. During the year 1920, the production was 3,013,463 barrels of cement, the value of which at the mill was $6,545,053. Wages to the amount of $1,351,496 were paid to 869 workmen.

BRICK

Brick-making and lime burning were two of the first industries of the country. It would seem that the first bricks were burned in Canada about 1685 on the left bank of the Lairet river near Quebec. Those who are interested in historical records, will find in "Les Bulletins des Recherches Historiques" published in Quebec, by Mr. Pierre Georges Roy, interesting information on the first brick-yards worked under the French Régime.

Apart from Mr. Roy's notes and of the few allusions to brick-making in the Jesuits Relations, there is but little information regarding the development of brick-making in the Province of Quebec. In his classic report on the Geology of Canada, published in 1863, Sir William Logan mentions that there were then in Montreal two principal brick-yards with a yearly output of 6,000,000 bricks each. These bricks were sold at about $5.00 a thousand.

Since then the industry has greatly developed and in 1911, the year of the greatest production, 176,532 thousand bricks was made in the Province. To a greater extent than in the case of limestone, during the past twelve years, the sales of bricks varied in proportion to the activity in the building trade. Cost of labour and of fuel are factors in the fluctuation of the yearly value.

It is more than probable that the period of wide fluctuation in the demand is over and that the minimum of production

occurred in 1918 ; then the quantity of bricks manufactured was only one third of the production of 1911. Builders expect renewed activity during 1922, and there is no doubt that the figures in the table of production will represent a large amount.

The chief centre of the brick-making industry in the Province of Quebec is at Laprairie. In a distance of four miles the National Brick Co. of Laprairie, Ltd operates three brick-yards : the first one at Laprairie 14 miles west of Montreal, and the two others at Delson Junction. These two points are situated on the line of the Grand Trunk Railway from Montreal to Massena Springs. The Montreal-Sherbrooke branch of the Canadian Pacific connects Delson with Montreal. At these two places the plastic shales of the Utica-Lorraine formation are worked. These underlie a considerable part of the county of Laprairie. They occur as thin horizontal beds interstratified with others more or less silicious. The rock is very friable which makes it easy to work with a steam shovel. It is conveyed to the factory in five ton cars. Then it is ground under two mullers in a dry pan nine feet in diameter. The dust is screened and the quantity of water required for the tempering is added. The thick mud is driven out of the pug mill by a helicoidal screw and comes out in the shape of a ribbon to be wire cut into bricks. The workmen place the green bricks in trucks to be placed in the dryers which are long chambers heated by the waste gases from the kilns or by an independent source of heat. The bricks after remaining 24 hours in the dryer are placed in kilns to be burned.

The kilns are large rectagular chambers with vaulted roof, 45 feet long by 15 feet wide. Eight chambers form a set or battery. Each battery can turn out 100,000 bricks a day. The burning is continous and is effected with soft coal mixed with anthracite. There are no fire boxes. The fire is in direct contact with the bricks. Coal is shovelled through a series of small openings in the roof of each furnace. Elsewhere, as at the Loomis brick works at Lennoxville the burning is done with producer gas.

Besides the brick-yards of Laprairie and Delson there are other important ones in the Province of Quebec. In the neighborhood of Sherbrooke there are the Ascot and Lennoxville ones. A few miles only from Quebec at Boischatel there is the plant on the Citadel Brick & Paving Block Co. Ltd. At St. Jean Deschaillons in the county of Lotbinière, on the south bank of the river St. Lawrence, large quantities of bricks have been sent in barges to Montreal for many years. In 1913 there were at that place 23 brick-yards employing 350 men. Since then, the manufacturers have been obliged, one by one, to give up operating ; at present only two of the operators remain. St. Tite-de-Champlain was for many years an important producing centre. During the war, work was completely stopped. The activity of the building trade during the past summer enabled the brick-making to be resumed there.

The brick-making industry and pottery are closely connected ; they are but different methods of utilising material from clay-pits. The pottery industry includes the manufacturing of special shapes of bricks, of earthern-ware, of vitrified products and of refractory bricks. At Lakeside, west of Montreal, The Montreal Terra Cotta Co., Limited manufactures exclusively hollow bricks. Other plants with modern machinery also manufacture them. At L'Islet the manufacture of drain-pipes has begun for the first time in this Province. This is an industry which comes at the proper time and which will find an important market in the Province.

Hitherto the Quebec clay industry has been limited to the manufacture of bricks for buildings. Lack of information regarding the qualities of the rocks of Quebec has delayed the working of deposits hitherto unknown. Before 1912 the existence of vitrifiyng shales in the valley of the St. Lawrence was unknown. Thanks to the researches of Mr. Joseph Keele, the ceramic-engineer of the Department of Mines at Ottawa, we now know that there are in certain places shales of the Levis and Sillery formations possessing vitrifiyng qualities. These shales

have a high fusing point and with them bricks for paving and sewer pipes can be made.

Last spring experiments made with samples of red shales from the seigniory of Lepage-Thibierge in the county of Matane showed that there were in the vicinity shales from which vitrified wares could be made.

Besides these industries, which can find their raw material in the country, there are in the Province important pottery plants which import their raw-material. At St. John's there are factories of ceramic ware ; amongst others that of Mr. C. H. Farrar, specializes in the making of chinaware ; the Standard Clay Products Company, Limited is the only establishment which makes sewer pipes ; the Canadian Potteries Company, Limited produces sanitary pottery such as tubs, washstands, baths, sinks. These plants import from the State of New Jersey, the refractory clay required for making the manufactured articles, and at times to this material, they add a certain proportion of local clay. About half a century ago there was at Cap Rouge near Quebec a plant to manufacture stoneware. Glazed ware of superior quality made with clay imported from New Jersey was manufactured there.

Quebec is poor in refractory clay. The deposit of kaolin at St-Rémi d'Amherst is the only deposit known in the Province. Besides the white kaolin, which could be utilized in the manufacture of porcelain and as a high grade paper filler, there is also a considerable quantity of discoloured clay which could be made into excellent fire bricks. At St. John's and Montreal there are three plants making refractory bricks and special shapes for cupola blocks, locomotive boiler settings, muffles and laboratory goods. But the raw materials are also imported from New Jersey.

GRANITE

The granite quarries of the Province produced nearly half a million dollars of granite in 1920. This is a considerable production which was surpassed only in 1913 and 1914. It is diffi-

cult to compare from year to year the quantity of stone taken out ; such a comparison would be moreover unreliable because the same weights of stone have different prices depending on the amount of work done on them ; some operators sell stone in the rough while others cut it into paving blocks and others still work it and make dimension stone for the construction of buildings. As the methods of quarrying granite have not changed, the best indication of the activity of the quarry operations is that of the number of men employed reduced to a common denominator of 300 days work. The statistics do not give the figures for the period prior to 1913. That year there were 628 men employed at various works in the granite quarries ; in 1915 there were 106 ; in 1920 the number rose to 243. The activity for that year was only 40% of what it was in 1913.

Number of 300-day workmen employed in the Granite quarries in the province.

1913.....628	1916.....294	1919.....177
1914.....408	1917.....111	1920.....243
1915.....106	1918.....170	1921 188

Granite quarries are being worked at various places in the Province. The principal ones are those situated at Brownsburg in the county of Argenteuil ; at Guénette near Mont-Laurier ; at Rivière-à-Pierre in the county of Portneuf ; at Roberval on Lake St. John ; at Charlesbourg near Quebec ; at St. Sebastien near Megantic ; at Graniteville in the county of Stanstead and Mount Johnson in the county of Iberville.

The Brownsburg quarries are situated in the township of Chatham. From these a rather coarse grain stone of a pink to chocolate colour is obtained. It is mostly use for monuments. and as building material. During the past years a large quantity of blocks were made for paving the streets of the city of Montreal. This stone is very well suited for the turning of columns as may be seen at the Hochelaga Bank building at Three Rivers. At Guenette in the township of Campbell there is a batholith of

fine-grain granite of a light red colour. It is chiefly used for paving blocks. The granite of Rivière-à-Pierre on the line of the Lake St. John Railway is especially suitable for making dimension stones. This granite was used in constructing the piers of the Quebec Bridge. It is a very coarse-grain granite. The crystals of red feldspar are abundant as is also the percentage of the black element. This stone is sought for in connection with the contruction of large buildings. The church of Ste. Thècle in the county of Champlain, of St. Roch and of Saint-Coeur de Marie in Quebec, clearly show its adaptibility to large monuments. From the granite quarried west of Roberval, on Lake St. John is produced a very coarse grained stone which contains a profusion of red orthoclase crystals. This granite has been used in the construction on many buildings ; among others the church of St. Prime, the drill hall in Quebec and the city hall at Roberval.

On the south side of the River St. Lawrence there are large masses of granitic stone forming mountains whose altitude makes them a remarkable feature in the topography of the whole region. On the side of these mountains there are quarries in operation ; chiefly in St. Sébastien in the county of Beauce and at Graniteville in the county of Stanstead. In the plain south of Montreal the Paleozoic formations are pierced by volcanic necks which have given rise to the Monteregian hills. They are formed of rocks of a dark colour and are granitic in texture. The church of West-Shefford has been built with nordmarkose from Brome mountain. At present the only hill in which quarrying is carried on is Mount Johnson in the parish of St. Grégoire le Grand. It yields a stone of medium grain and dark colour known in the trade under the name of black granite. It is mostly used for monuments.

The Megantic granite comes from a large batholith known locally as the "Morne". On its western side, along the line of the Quebec Central Railway at St. Sébastien, St. Samuel and Ste. Cécile, several quarries have been worked. They yield a light grey stone with generally medium grain. This granite is sought by builders. It has been used in the buildings of many

churches, among others ; that of St. Jean Baptiste in Sherbrooke and the new church of Les Pères du St. Sacrement on St. Foye Road in Quebec.

The Stanstead granite is known throughout the whole Dominion. It is a generally uniform grained, greyish white granite formed of orthoclase and plagioclase feldspars, with a little quartz and small scales of black mica. The Sherbrooke Post Office, the buildings of the Royal Trust, the Bank of Commerce, the Eastern Townships Bank, and of the Grand Trunk on McGill Street Montreal, have been constructed of Stanstead granite. It has been used for the construction of several important buildings in the principal cities of Western Canada. At Beebe village the Stanstead Granite Co., Ltd. has a large very modern mill where stone-cutting, and the polishing of granite are done by mechanical methods. The plant comprises two machines for sawing blocks ; three polishers, a planer, moulding and polishing lathes. Columns 25 feet long turned and polished have been made in this plant. The colonnade on the front of the Municipal library of Montreal is an excellent example of the work done there.

Besides the granites described above there is a number of places where outcrop granitic rocks suitable for building purposes. Among others may be mentioned the gray granite of Point-Magoon on Lake Memphremagog ; of Stanhope in the county of Stanstead ; of Orford Mountain in Sherbrooke ; of Danville near Richmond ; of St. François de Beauce ; of Hebertville at Lake St. John etc..

The outcroppings of granitic rocks in the Province are numerous. One has but to look at the geological map to see this. The Laurentian plateau contains many batholiths of granite, syenite, gabbro and anorthosite. These deposits are not all workable. It is possible that the colour or the grain of the rocks outclasses them ; that the distance to railways or to buildings centres prevents their economic employment. On the south side of the river each of the Monteregian hills can give decorative stones. And the granitic rocks found in the Appalachian chain have no doubt a reserve of fine building stones.

SANDSTONE

During the past years very little work has been done in the sandstone quarries of the Province in connection with buildings. The slight production mentioned in the statistics represents only materials for road making. This sandstone is employed for road metal or is cut into paving stone for streets. None has been taken out for building purposes. Formerly the green sandstones of the Sillery formation were in great demand as building material. In Quebec the fortification walls, the basement of the Government buildings and of the Court house, the Roman Catholic Church of Notre Dame du Chemin, and St. Matthews Anglican Church on St. John Street were built of Sillery sandstone.

In the Province there are several geological strata formed of sandstone beds outcropping over considerable areas. These are the Potsdam, Sillery, Niagara and Gaspé formations. Immediately west of Montreal the Potsdam formation underlies the counties of Huntingdon, Beauharnois, Chateauguay, Vaudreuil, Soulanges and Two Mountains ; then it runs west along the foot of the Laurentian plateau as far as the township of Onslow while to the east it extends beyond the Grès rapids on the St. Maurice river.

The sandstone of the Potsdam formation is hard and generally white. Some beds are rusty owing to oxide of iron and assume slight tints of yellow and brown which produce pleasing effects. At Beauharnois several houses have been built of sandstone from the neighbouring quarries. At Ottawa some of the streets have been paved with sandstone blocks from the St. Scholastic region.

The sandstone of the Sillery formation outcrops chiefly in the Quebec region where it is found associated with red, green and grey slates. This formation forms an irregular band extending from Lake Champlain to Gaspé Point. Its general direction is parallel to the axis of the Appalachian mountains. In

the Eastern Townships it appears in the denuded folds of the anticlinals of the three chains of mountains known as the Sutton, the Stoke and the Megantic. From Levis to Gaspé it forms a band nearly twenty miles in width into which are embedded, parallel bands of white quartzite, between St. Jean Port Joli and Kamouraska. Quarries have been worked in the sandstone formation of Sillery near the village of that name and at Neilsonville, west of Quebec, at St. Romuald and St. David in the county of Levis, at St. Raphael and at Armagh in the county of Bellechasse, at L'Islet, at Fraserville and at St-Octave-de-Metis. This sandstone is dark green in colour. It consists of grains of various sizes, of quartz and feldspar, bound by a clayey paste. Some say that this stone scales off under the action of the weather. The solidity of the blocks with which the fortifications walls have been built and which have so well resisted the climate of Quebec leads one to believe that this is an undeserve censure.

On the east shore of Lake Témiscamingue, at Pointe-à-Piché in the township of Guigues, Niagara sandstone was quarried for the Presbyterian Church at Haileybury. This stone is of a yellowish green. It is soft in the quarry but hardens when exposed to the air.

In the Gaspé Peninsula occur sandstones of Devonian age. A quarry has been worked at Causapscal on the Intercolonial railway for building the piers of the bridges. This stone is of fine grain and uniform and of a brown red very attractive colour. On the banks of the Baie des Chaleurs at Pointe-à-Bourdeau in Bonaventure, there is a sandstone of olive green colour which has been used in building the church at Mission-Point on the Restigouche River opposite Campbellton N. B.

SLATE

All the slate quarries known in the Province of Quebec are situated on the South shore of the St. Lawrence. They are found in the chains of mountains forming the prolongation of the Appalachians through that part of the Province.

Slate deposits have been known to exist in the Eastern townships for a number of years. The first serious work was done in the township of Cleveland in Richmond county in 1854. Since then many attempts have been made to operate various other deposits, but always without much success to the operators. A single quarry, that of New-Rockland in the county of Melbourne, has produced regularly.

The Quebec slates belong to the Cambrian and Ordovician formations. They are generally found near intrusions of serpentines.

The Cambrian slates are red, green, violet or speckled. They outcrop especially in the regions of Granby, Acton, Kingsey, Brompton, Garthby, Frampton as well as in proximity to the Ordovician deposits of Melbourne. The Ordovician slates are of dark colours varying from bluish grey to bluish black. The latter have been worked most. The chief slate quarries are those in the regions of Melbourne, Cleveland, Danville, Brompton, Orford, Halifax, and Glendyne in Témiscouata.

By reading the reports of the statistics of the Mineral Production of Canada as compiled by the Mines Branch at Ottawa, interesting information will be found regarding the production of the slate quarries. Thus it will be seen that the year 1889 shows a maximum production. The quantity of slate sold was 695 tons valued at $119,160. From that year, the quantity gradually decreased, but less rapidly than the value. In 1909 the production was 4,000 tons valued at $19,000. In 1919 the production decreased still more ; the value of the sales amounted to $10,835. These figures are interesting in so far that they practically show the production of a single quarry, that of Melbourne. This production is very small when compared with the value of imports. In 1920 Canada imported, chiefly from United States, roofing slate to the value of $71,341 ; school slates for $82,620 ; slate pencils for $16,467 and manufactured articles for $97,097. Say a total importation of $267,525.

If the Province lost ground in the extraction of its slate for school purposes, on the other hand, in the year 1921, several companies built mills for crushing slate. Last year, three such mills were in operation ; there is one near Kingsbury in the county of Richmond, another at St. Joseph de Beauce and the third at St. Anselme in the county of Dorchester. Slate, after being crushed and screened is used in making composite paper for roofing. The manufacturer make this product by putting a coat of broken stone on strong paper soaked in bitumen or asphalt. The manufacturers seek above all to obtain a substance of a bright colour. The Cambrian slates of red and green colours are very well suited for this.

Annual production of granite, slate and sand in the province of Quebec.

Year	Granite	Slate	Sand
	Value in dollars	Value in dollars	Value in dollars
1909	149,064	24,000	.....
1910	291,240	18,492	.....
1911	308,545	8,248	62,000
1912	358,749	8,939	170,600
1913	496,588	6,286	405,750
1914	582,235	5,105	446,532
1915	269,350	2,039	210,809
1916	292,270	6,223	168,891
1917	167,659	7,789	161,840
1918	224,861	5,124	87,308
1919	334,692	10,853	180,987
1920	494,372	14,200	206,433
1921	369,122	48,766	283,813

SAND

Sand plays an important part in connection with building. The amount used in the Province in 1920 reached the figure of

nearly 400,000 tons estimated at $206,433. This value does not represent one half of the sales for 1914.

There are many deposits of sand and gravel in Quebec. Their economic value is in direct ratio to their distance from the places where they are to be used and the facilities of transportation. The greatest proportion of the production comes from the sand-banks along lakes and rivers. They are chiefly worked in the lake of Two Mountains at Oka ; in the river St. Lawrence near Three Rivers, and at Quebec in the bed of the river St. Charles. Operations are also carried on in the sandbanks which are the remnants of the terraces of the Champlain epoch which are found on the north side of the river St. Lawrence at the foot of the Laurentian plateau and, on the south side along the chain of the Sutton mountains. The principal ones are those of Joliette on the St. Gabriel branch of the Canadian Pacific Railway ; of St. Jerome and Mont-Rolland on the Mount Laurier branch of the same railway ; of south Durham on the Richmond line of the Grand Trunk Railway, and at Valley Junction on the line of the Quebec Central Railway. It is needless to give the names of all the sand-pits of the Province. Sands of lacustral origin are found nearly everywhere.

As a conclusion to the foregoing remarks it may be said that the Province of Quebec possesses, within its immense territory, all the necessary materials for erecting and decorating all classes of buildings, residences, commercial buildings and religious edifices. It is not necessary to have recourse to the stone of foreign countries nor to artificial products to have good and beautiful buildings. Architects can give an agreeable aspect to buildings by availing themselves of the combinations which can be obtained from the various materials found in the country. If we wish to give local colour to each of our towns it will be necessary to build with materials derived from the neighbouring quarries.

The foregoing descriptions of the geology and geography of Quebec's building materials resume in a brief summary the information which we possess through the geological exploration

work which has been done from time to time. The limited knowledge we possess regarding the rocks which compose the various geological systems, merely allow of broad surmises as to their economic possibilities. The existence of all the deposits of materials suited for building and ornamental purposes will not be known until the geology of the Province has been studied and mapped systematically. So far the initiative in connection with researches has been left to the caprices of prospectors. To them we owe the discovery of the quarries at present in operation.

LIST OF THE PRINCIPAL OPERATORS AND OWNERS OF MINES AND QUARRIES IN THE PROVINCE OF QUEBEC

ASBESTOS

Asbestos Corporation of Canada, Limited,
J. McCallum, Secretary, Thetford Mines, Que.

Asbestos Crude and Fibre Mining Corporation,
Black Lake, Que.

Asbestos Mines, Limited,
East Broughton, Que.

Asbestos Quarries, Ltd,
Black Lake, Que.

Beaudoin, P. E.
Thetford Mines, Que.

Bell Asbestos Mines,
O. C. Smith, Manager, Thetford Mines, Que.

Bennett-Martin Asbestos and Chrome Mines, Limited,
Thetford Mines, Que.

Black Lake Asbestos and Chrome Co., Limited,
Black Lake, Que.

The Bolton Mining Company, Limited,
Eastman, Que.

Canadian Johns-Manville Co., Limited,
Asbestos, Que.

Consolidated Asbestos, Limited,
Norman R. Fisher, Mgr., Thetford Mines, Que.

Federal Asbestos Company,
Robertsonville, Que.

The Frontenac Asbestos Mining Co.,
F. W. Ross, 92 St. Peter Street, Quebec City.

General Asbestos., Limited,
East Broughton, Que.

Guillemette, Donat,
Thetford Mines, Que.

Johnson's Co.,
A. S. Johnson, Mgr., Thetford Mines, Que.

Lake Frontière Asbestos Company, Limited,
Lake Frontière, Que.

Maple Leaf Asbestos Corporation, Limited,
Thetford Mines, Que.

The Pennington Asbestos Company,
Thetford Mines, Que.

Quebec Asbestos Corporation,
E. E. Spafford, Mgr, East Broughton, Que.

Queen Asbestos, Limited,
St. Cyr, Richmond county, Que.

St. Adrien Asbestos Mines, Limited,
St. Adrien de Ham, Que.

Windsor Asbestos Company, Limited,
Coleraine, Que.

CHROME

Bennett-Martin Asbestos and Chrome Mines, Limited,
Coleraine, Que.

Black Lake Asbestos & Chrome Co., Limited,
Black Lake, Que.

Dominion Mines & Quarries, Limited,
Canada Life Building, Toronto, Ont.

Quebec Asbestos & Chrome Co.,
Douglas B. Sterrett, Manager, St. Cyr, Richmond Co., Que.

United States Ferro-Alloys Corporation,
Black Lake, Que.

Victory Chrome Mines, Ltd.,
103 St. François Xavier, Montreal.

COPPER

Eastern Mining & Milling Co., Limited,
Eastman, Que.

Eustis Mining Company,
F. M. Passow, Manager, Eustis, Que.

La Compagnie Minière de Glendyne, Limitée,
Glendyne, Que.

Weedon Mining Co., Limited,
L. D. Adams, Pres., 201 Bank of Nova Scotia Bldg., Montreal.
Montreal, Que.

DOLOMITE

White Grit Company,
Portage du Fort, Que.

FELDSPAR

British Minerals Corporation,
605 McGill Bldg., Montreal.

The Buckingham Feldspar Company,
Buckingham, Que.

Bush Winning,
N.-D. de la Salette, Que.

Masson, W. G.,
72 Spark St., Ottawa.

O'Brien & Fowler,
Union Bk. Bldg., Ottawa.

Watts and Noble,
Kirks Ferry, Que.

GOLD

Eustis Mining Co.,
Eustis, Que.

Kienawisik Mines Limited,
Amos, Que.

The Kienawisik Gold Mining Co., of Portland, Maine,
18 Tremont St., Boston, Mass.

The Lake Fortune Mining Co., Limited,
27 Lemoine St., Montreal.

Martin Gold Mining Co.,
Amos, Que.

Northern Quebec Goldfields and Exploration Co.,
Three Rivers, Que.

Joseph F. Stabell,
1127 Niagara St., Buffalo, N. Y.

Zinc Company, Limited,
Room 201, Bank of Nova Scotia Bldg., Montreal.

GRAPHITE

Bell Graphite Co., Limited,
Box 185, Buckingham, Que.

Laurentian Graphite, Limited,
St. Rémi d'Amherst, Que.

North Quebec Mining Development Company, Limited,
Gédéon Frédette, St-Rémi d'Amherst, Que.

Plumbago Syndicate,
Excelsior Life Bldg., Toronto.

Quebec Graphite Co., Limited,
R. C. Rowe & C. N. Daly, Managers, Buckingham, Que.

The Standard Graphite Company, Limited,
30 St. James St., Montreal.

IRON & TITANIC IRON

American Titanic Iron Co.,
J. H. Boisvert, Parliament Bldg., Quebec City.

Baie St. Paul Titanic Iron Ore Co.,
J. O. Paré, Manager, Baie St. Paul, Charlevoix, Co., Que.

The Loughborough Mining Co., Limited,
Sydenham, Ont.

Manitou Iron Mining Co.,
Jos. E. Globensky, 364 University Street, Montreal.

KAOLIN

The Canadian China Clay Co., Limited,
Huberdeau, Que.

MAGNESITE

J. F. Inglee,
94 Binscarth Road, Toronto.

International Magnesite Co., Limited,
1005 Bank of Nova Scotia Bldg., Montreal.

North American Magnesite Producers, Limited,
Calumet, Que.

Scottish-Canadian Magnesite Co., Limited,
P. O. Box 50, Grenville, Que.

MARL

Canadian Whiting Co., Ltd.,
St. Jérome, Qué.

MICA

W. Ahearn, Jr.,
538 McLaren St., Ottawa.

Wm. Argall,
Laurel, Que.

Blackburn Brothers,
Union Bank Bldg., Ottawa.

Brown Brothers,
Cantley, Que.

Bush Winning,
Notre-Dame, de la Salette Que.

Calumet Mica Co.,
Campbell's Bay, P. Q.

Canadian Amber Mica Company,
P. O. Box 246 Station B, Montreal.

Capital Mica Co., Limited,
W. Ahearn, Manager, St. Pierre de Wakefield, Que.

Chabot & Co.,
124 Rideau St., Ottawa.

Cross & Wilson,
Cascades, Hull, Co. Que.

Dougherty Brothers,
Wakefield, Que.

H. T. Flynn,
106 Montcalm Street, Hull, Que.

J. B. Gauthier,
Box 226, Buckingham, Que.

J. B. Gorman,
Box 166, Buckingham, Que.

Wm. Gowan,
Holland Mills, Que.

Hamilton Syndicate,
Perkins, Que.

The Laurentide Mica Company, Ltd.,
119 Queen Street West, Ottawa.

The Loughborough Mining Co.,
N. J. Sproule, Manager, c-o G. W. McNaughton, Sydenham, Ont.

McGlasham Mining Syndicate,
Cantley, Que.

A. Nault,
Rivière Desert, Que.

O'Brien & Fowler,
410 Union Bank Bldg., Ottawa, Ont.

L. Richard & Company,
L'Ange Gardien, Que.

Sherbrooke-Saguenay Mica, Limitée,
136 King St. W. Sherbrooke, Que.

Wallingford Bros, Limited,
77 Vaughan St., Ottawa.

Wallingford Bros Limited,
Perkins, Que.

Wallingford Mica & Mining Co.,
Banque Nationale Bldg., Ottawa, Ont.

Watts and Noble,
Farm Point, Que.

Wilson, S. C.,
Cascades, Que.

MINERAL WATER

Abenakis Springs Company, Limited,
W. E. Watt, Manager, Abenakis Springs, Que.

J. N. Ducharne,
L'Epiphanie, Que.

Eaux Minérales Naturelles de St. Vallier, Enrg.,
St. Vallier, Bellechasse Co., Que.

Alfred Ferland,
Village St. Benoit, Two-Mountains Co., Que.

Radnor Water Co., Limited,
Lewis Bldg., Montreal, Que.

Cyprien Roy,
St. Germain, Kamouraska Co., Que.

D. Veillet & Cie.,
Ste. Geneviève, Batiscan Co., Que.

MOLYBDENITE

L. N. Benjamin,
108 Laurier Ave. West, N.

Daley Molybdenite Co.,
263 Sparks St., Ottawa, Ont.

Dominion Molybdenite Co., Limited,
M. L. Foley, 12 Maynard Ave., Toronto.

The Height of Land Company,
S. P. Wilson, Mgr., 316 St. James. St., Montreal.

St. Maurice Mines Co., Ltd.
c-o W. J. Haines, 1011 Chesnut St., Philadelphia, Pa.

Wood Molybdenite Company, Limited,
14 Metcalfe St., Ottawa, Ont.

NATURAL GAS

The Canadian Natural Gas Co.,
P. O. Box 2072, Montreal.

The National Gas Co., of Canada,
c-o Mr. E. B. Devlin, Hull, Que.

OCHRE AND IRON OXIDE

Argall's Oxide Mines,
P. O. Box No. 5, Three Rivers, Que.

Canada Paint Co., Limited,
Jos. Bradley, Manager, Red Mill, Que.

The Champlain Oxide Co.,
Lucien Carignan, Manager, Three Rivers, Que.

P. Jobidon,
12 Ste. Famille St., Quebec City.

François Ouellet,
Ste-Gertrude, Nicolet Co., Que.

PEAT

J. M. O'Brien, Ltd.,
511 Union Bk. Bldg., Ottawa.

Les Tourbières des Laurentides, Ltd,
Ste. Flore, Que.

PHOSPHATE

Blackburn Bros.,
H. L. Forbes, Manager, Union Bank Bldg., Ottawa.

J. G. Higginson,
Buckingham, Que.

O'Brien & Fowler,
410 Union Bank Bldg., Ottawa.

Wallingford Bros., Limited,
Perkins, Que.

Edward Watts,
19 Chestnut Park, Toronto, Ont.

SILICA, ROCK AND SAND

J. Bonnell,
Buckingham, Que.

The Canadian China Clay Co., Limited,
43 Victoria St., Toronto, Ont.

Consolidated Sand Company,
270 Ottawa St., Montreal.

J. B. Gorman,
Box 166, Buckingham, Que.

J. McClements,
Buckingham, Que.

G. Pedenaud,
Glen Almond, Que.

A. Sicard,
St. Canute, Que.

Silica Products, Registered,
45 St. Alexander St., Montreal.

Silica, Limited,
103 St. François Xavier, Montreal.

Temple Silica Sand, Ltd.,
East Templeton, Que.

SILVER

Eustis Mining Co.,
F. M. Passow, Manager, Eustis, Que.

Weedon Mining Company,
L. D. Adams, President, Weedon, Que.

Zinc Company, Limited,
Room 605, Bank of Nova Scotia Bldg., Montreal.

TALC

Louis Cyr,
Coleraine, Que.

J. N. Martel,
Belmina, Wolfe Co., Que.

Canada Paper Co., Ltd.,
Windsor Mills, Que.

Talc Development Co. of Canada, Ltd.,
Mansonville, Que.

Geo. R. Pibus,
Knowlton, Que.

ZINC AND LEAD

Federal Zinc and Lead Co., Ltd.,
285 Beaver Hall Hill, Montreal, Que.

The New Richmond Mining Co.,
New Richmond, Que.

North America Mining Co.,
New Carlisle, Que.

Pierre Tétreault,
4300 Notre Dame St., East, Montreal, Que.

Zinc Company, Limited,
Notre Dame des Anges, Portneuf Co., Que.

BRICK

The Ascot Tile & Brick Co., Limited,
Ascot Corner, Que.

D. Bertrand,
St. Victor de Tring, Que.

Brompton Clay Hills, Inc.,
Bromptonville, Que.

The Citadel Brick & Paving Block Co., Limited,
P. Galarneau, Manager, 421 St. Paul St., Quebec City.

La Compagnie de Briques de l'Abitibi,
Amos, Que.

La Compagnie de Briques de Deschaillons,
Deschaillons, Que.

La Compagnie de Briques de l'Islet, Ltée,
L'Islet Station, Que.

La Compagnie de Briques de Matane,
St. Jérôme de Matane, Que.

Jos. Desrochers,
Warwick, Que.

Granby Clay Products, Limited,
P. O. Box 266, Granby, Que.

David F. Hodgins,
Box 87, Shawville, Que.

L'Industrielle St. Tite, Limitée,
St. Tite, Champlain Co., Que.

Nap. Loiselle,
Granby, Que.

Emile Longpré,
St. Félix de Valois, Que.

W. E. Loomis,
Sherbrooke, Que.

The Alex. Mills Brick Co., Reg'd,
Ormstown, Que.

The Metis Shale Brick Co., Limited,
St. Octave de Metis, Que.

National Brick Co. of Laprairie, Limited,
511 St. Catherine, West, Montreal.

Paradis & Letourneau,
Stadacona, Quebec City.

Ulderic Paris,
Village Deschaillons, Que.

Proulx Brothers,
Richmond, Que.

The St. Lawrence Brick Co., Limited,
71 St. James Street, Montreal, Que.

CEMENT

Canada Cement Co., Limited,
F. P. Jones, Manager, Herald Building, Montreal.

GRANITE

Aug. Bernier,
Roberval, Que.

Louis Bertrand,
Shawinigan Falls, Que.

James Brodie & Son,
Graniteville, Que.

Brodies, Limited,
128 Bleury Street, Montreal.

Joseph Brunet,
663 Côte des Neiges Road, Montreal.

La Carrière Bussière, Limitée,
St. Sebastien, Que.

La Compagnie de Granit de Charlesbourg, Limitée,
Quebec City, Que.

Augustin Delisle,
Rivière à Pierre, Que.

Dumas & Frère,
Rivière à Pierre, Que.

William Duncan,
Graniteville, Que.

Filton & Parmenter,
North Derby, Que.

Arsène Gosselin,
St. Samuel Station, Que.

Jobin & Genois,
113 Côte d'Abraham, Quebec City.

J. C. Lacasse,
Beebe, Que.

James McKenzie,
Graniteville, Que.

Pierre Moreau,
Roberval, Que.

S. B. Norton,
Beebe, Que.

Mrs. Jos. N. Perron,
Rivière à Pierre, Que.

Stanstead Granite Quarries Co., Limited,
Beebe Jct., Stanstead, Co., Que.

F. Voyer & Frère,
Rivière à Pierre, Que.

LIME

Arnaud & Beaudry,
Joliette, Que.

Adolphe Barron,
La Carrière, Que.

Delphis Beauregard,
Stukely, Que.

Arthur Boivin,
Pont Rouge, Portneuf Co., Que.

R. B. Carswell,
Bryson, Que.

Achille Desilets,
St. Louis de Champlain, Que.

Dominion Lime Co.,
Sherbrooke, Que.

Octave Héon,
St. Louis de Champlain, Que.

Magloire Leclerc,
St-Dominique, Que.

Thos. McCambly,
Kazubazua, Que.

Montreal Lime Co.,
31 Prenoveau St., Montreal.

Placide Sanche,
Ste Thérèse, Que.

Thos. Sharpe,
Coldwell, Que.

Sovereign Lime Company, Limited,
Delorimier Ave. and C.P.R. Tracks, Montreal.

Standard Lime Co., Limited,
St. Paul, Joliette Co., Que.

St. Maurice Lime Company, Limited,
P. O. Box 479, Trois Rivières, Que.

Succession O. Limoges,
40 Pouport St., Montreal.

Wright & Company, Incorporated,
Hull, Que.

LIMESTONE

Jos. P. Beaudry,
Joliette, Que.

Clovis Bédard,
St. Marc des Carrières, Que.

L. O. Bergevin,
Chambly Canton, Que.

William I. Bishop, Limited,
10 Cathcart St., Montreal.

Canada Carbide Company, Limited,
Power Building, Montreal.

Carrière de Québec, Limitée,
319 rue St-Paul, Quebec City.

La Cie des Carrières,
St. Marc des Carrières, Que.

La Cité de St. Hyacinthe,
St. Hyacinthe, Que.

La Cité de Hull,
Hull, Que.

Alderic Cousineau,
2455, St. Urbain Street, Montreal.

The Delorimier Quarry Co.,
1952 Iberville St., Montreal.

Frank Deraiche,
Port Daniel Est, Gaspé Co., Que.

Deschambault Quarry Corporation,
52 St. Paul St., Quebec City.

The Deschambault Stone Co., Limited,
St. Marc des Carrières, Que.

Edgar Desormeaux,
Cap St. Martin, Laval, P. Q.

Pite Desroches,
Joliette, Que.

Cyrille Durocher,
5383 Notre Dame St., Montreal, Que.

Art. E. Dussault,
St. Marc des Carrières, Que.

The Federal Stone & Supply Co., Limited,
339 Queen St., Ottawa.

Martin Gagnon,
3595 St. Hubert St., Montreal.

E. L. Gravel,
Château Richer, Que.

Francis Gravel,
Château Richer, Que.

Grondines Quarry Co., Ltd.,
704 Power Bldg., Montreal.

Institution des Sourds-Muets,
3600 St. Lawrence St., Montreal.

Joliette Castings & Forgings Ltd.,
Joliette, Que.

Kennedy Construction Co., Limited,
310 Shaughnessy Bldg., Montreal.

The Félix Labelle Quarry Co., Limited,
St. François de Sales, Que.

Georges Labelle,
St. François de Sales, Que.

Joseph Lapointe,
74 Montée St. Laurent, Cartierville, Que.

Laurentian Stone Co., Limited,
53, rue Albert, Hull.

Edgar Lawrence,
Port Daniel, Que.

Victor Lecrenier,
Cap St. Martin, Laval Co., Que.

Narcisse Lord,
St. Jean, Que.

Mahony & Rich Quarries, Limited,
Besserer St., Ottawa, Ont.

Maisonneuve Quarry Co., Limited,
2855 Boulevard Rosemont, Montreal.

O. Martineau & Fils, Limited,
371 Marie Anne Ave., Montreal.

R. H. Miner & Co., Ltd.,
Guarantee Bldg., Montreal.

Montreal Crushed Stone Co., Ltd.,
590 Union Ave. Montreal.

Montreal Quarry Limited,
800 Bellechasse St., Montreal.

Jos. D. Naud,
St. Marc des Carrières, Que.

Joseph Pagé,
Charlesbourg, Que.

Jos. Poulin,
Château Richer, Que.

John Quinlan & Co.,
1165 Greene Ave., Westmount, Que.

Richelieu Quarry, Ltd.,
St. John, Que.

Thomas Rogers,
1701 Iberville Street, Montreal.

A. Simard,
Chambly, Que.

The St. Laurent Quarry, Limited,
Cap St. Martin, Laval Co., Que.

Standard Lime Co., Limited,
Joliette, Que.

Stinson-Reeb Builders' Supply Co., Ltd.,
45 Alexander St., Montreal, Que.

Napoléon Tremblay,
Joffre Avenue, Hull, Que.

Elzéar Verreault,
191 rue du Pont, Québec.

Villeray Quarry Co., Limited,
848 Du Rosaire Street, Montreal.

MARBLE

The British Canadian Marble Co., Ltd.,
St. Joseph de Beauce, Que.

The Pontiac Marble & Lime Co., Limited,
193 Sparks St., Ottawa.

Wallace Sandstone Quarries, Ltd.,
Philipsburg, Que.

POTTERY

W. D. Bell,
1286 St. Valier St., Quebec City.

The Canada Firebrick Works Co., Ltd.,
371 Aqueduc St., Montreal.

Canadian Potteries, Limited,
St. John's, Que.

Citadel Brick & Paving Blocks Co., Ltd.,
Quebec City.

Dominion Sanitary Pottery Co., Ltd.,
189 James St., Montreal.

G. H. Farrar,
Iberville, Que.

David T. Hodgins,
Shawville, Que.

La Compagnie de Tuyaux de Drainages,
L'Islet Station, Que.

Montreal Terra-Cotta Co., Ltd.,
511 St. Catherine St. West, Montreal.

Standard Clay Products, Limited,
St. John's Que.

SAND

Mde Vve Jean Aybram,
St. Emelie Junction.

Emile Berard,
Mount Johnson, Que.

Robert Boa,
Lachute, Que.

The Bonner Sand & Ballast Co., Ltd.,
204 St. Nicholas Bldg., Montreal.

Consolidated Sand Company,
270 Ottawa St., Montreal.

Euclide Gosselin,
Ascot Corner, Que.

Joseph Guertin,
St. Joseph de Sorel, Que.

Keystone Wall Plaster Co.,
Ste. Thérèse, Que.

Lachance Limitée,
99 rue Dalhousie, Quebec City.

Laurentide Co., Ltd.,
Grand'Mère, Que.

Laurentide Sand & Gravel, Ltd.,
7 St. James St., Quebec City.

Melançon & Frère,
Grand'Mère, Que.

Royal Moulding Sand & Gravel Co.,
St. Félix de Valois, Que.

Standard Lime Co., Ltd.,
Joliette, Que.

Napoléon St. Louis,
Fontarabie, Maskinongé Co., Qué.

SANDSTONE

Cascades Silica Products Co.,
103 St. François Xavier St., Montreal.

Miles Lonergan,
147 Mountain Hill, Que.

Consolidated Sand Co., Ltd.,
270 Ottawa St., Montreal.

Normand & Normand,
St. Romuald, Que.

H. F. Routhly,
Haileybury, Ont.

The Sydney Kirby Co., Ltd.,
213 Sussex St., Ottawa.

SLATE

The British Canadian Marble Company, Ltd.,
St. Joseph de Beauce, Que.

Canada Slate Corporation,
St. Anselme, Dorchester Co., Que.

New Rockland Slate Co.,
Room 601, Southam Bldg., 128 Bleury St., Montreal.

Slate Products Co., of Canada Ltd.,
P. O. Box 2199, Montreal.

STATISTICS OF ACCIDENTS

REPORTED FROM THE MINES AND QUARRIES DURING THE YEAR 1921

A. O. DUFRESNE *

The mines of the Province of Quebec felt the effects of the stagnation of the market for mineral substances. This inactivity has ben general throughout the world. In the Province since the end of the war in 1918, many of the mines have closed down one after the other ; and at the end of the year 1921 barely 25% were operating. After the signing of the treaty of peace, one of the first to discontinue operations was The Dominion Molybdenite Company, Limited, the owner of the Moss mine in the county of Onslow. About the same time the Quebec Asbestos and Chrome Company, which had discovered and successfully operated a deposit of chrome in the township of Cleveland, closed its plant. Then, one after the other, the chrome mines ceased to ship ores ; the Black Lake Asbestos and Chrome Company Ltd. dismantled the head-frame of its working shaft at the Caribou mines. In the same year the Dominion Mines and Quarries, Limited suspended all work on the Montreal pit mine ; The Mutual Chemical Company of Canada, Limited, withdrew its pumps in January 1921 and the underground workings are now flooded. The J. V. Belanger Mining Company, Limited, succeeded in holding out longer. Unfortunately, at the beginning of the fall of 1921 it was declared insolvent. Pretty much the same state of affairs exists in the copper mines of the Eastern Townships. After forty years of continuous production, the Eustis mine had to suspend its operations owing to the conditions of the sulphur and copper market. The Huntingdon mine has not produced since the month of March 1920, and the Weedon mine which, since 1910 worked on a rich deposit of copper-bearing pyrite, was obliged to dismiss its staff in May 1921. The zinc and lead

* Translated from the French.

TABLE I

PERSONS EMPLOYED IN THE MINES, QUARRIES AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC, DURING 1921

Mines, Quarries and Plants	Number of men Employed	Number of men calculated on 300 day basis	
	1921	1921	1920
Asbestos (quarries and mills)	2,753	1,920	3,533
Copper and pyrite, Silver, Gold	100	31	61
Chrome (mines and mills)	60	40	99
Feldspar, Kaolin (mines and mills)	90	66	29
Graphite, Mica, Phosphate (mines and mills)	111	59	141
Magnesite, Dolomite	168	104	194
Marl	10	4	3
Mineral paints, Ochre, (pits and mills)	44	35	55
Mineral water (springs and works)	6	3	5
Molybdenite	6	5	8
Quartz and Silica rock (quarries and mills)	48	15	53
Talc	0	0	1
Titaniferous iron ore, Zinc and Lead	92	33	122
Brick, Pottery, (clay pits and plants)	677	370	745
Cement (quarries and plants)	644	783	900
Granite (quarries and works)	300	188	243
Lime (quarries and kilns)	227	131	198
Limestone (quarries and dressing works)	1,047	799	777
Marble, Slate, Sandstone (quarries and works)	133	122	184
Sand (pit and river sand)	100	65	77
	6,616	4,773	7,428

TABLE II

	Number of workmen	Wages	Number of day's work	Number of 300-day workers
Producing mines. .	3321	$ 3,395,869	678,059	2260
Non-producing mines.	167	48,467	16,441	55
Totals. . .	3488	$ 3,444,336	694,500	2315

TABLE III

Workmen	Number 300 day workers	Accidents		Total	per 1,000 300-day workers
		Fatal	Non-fatal		
Mines.	2315	7	185	192	82.9
Quarries.	2458	5	16	21	8.5
	4773	12	201	213	44.6

mines at Montauban ceased to produce in April 1921. No titaniferous ore was shipped last year from Ivry or St. Urbain. The sales of graphite in 1921 were from stocks on hand ; while most of the mica deposits remained idle. The magnesite quarries had to reduce their working gangs by one half. At St. Rémi, only development work was done on the deposit of kaolin. Conditions were the same in the asbestos mines. At the end of the year, out of a total of 25 mines in activity during the war two only worked two shifts a day, eight worked part time, three did only repair work on the machinery and twelve have completely stopped all operations. Out of the non metallic products pro-

perly so called, feldspar is the only one which shown increased activity in 1921 as compared with the previous year. This increase activity is due to the discovery and operation of new deposits of orthoclase feldspar in the township of Derry, north of Buckingham.

Though much less pronounced than in the case of mineral products, operations in building materials also showed a rather considerable decrease. This result was not generally anticipated. A year of resumption of work in building operations had been expected, but the high cost of materials and labour was the cause of the postponement of many plans. Nevertheless according to the statistics given by the "Labour Gazette" published by the Federal Government, the value of building in the six principal cities of the Province, as shown by the buildings permits was, in 1921, $28,403,240 say an increase of $6,742,748 over the preceding year. The returns of the operators of quarries show a decrease in the value of the product and in the number of workmen employed. One of the reason for an increase in the value of building permits when a decrease in output in the quarries is recorded may be attributed to the fact that in Montreal, two important buildings, those of the Canada Cement Company and the Mount Royal Hotel have been built of artificial materials.

By table I it will be seen that during the year, 6616 men found employment in the mines and quarries. These men did not work continually. If we add up their days work and divide it by 300 days, which means a year of work, we get the number 4773 ; which is that of the men who worked a full year. By comparing this result with the total in the third column which represents the number of the 300-day workers for 1920 we find a decrease of 36% in the work of the mines and quarries for the past year. It is chiefly in the mines that the scarcity of work has been felt ; while in 1920 there were 4,304 300-day workers there were only 2315 last year, say a decrease of 46%. In the quarries the number of men who worked a full year dropped from 3124 to 2458, a decrease of 21%.

Of the 3488 men employed in mines, 167 were in mines which shipped no ore. These figures are apart from the assessment work required to be done under the Mines Act for keeping in force the rights on claims and on mining licences. The two principal mines which did development work without shipping ore are : The Lake Fortune Mining Co. Ltd., which operates a gold mine in the township of Boischatel, Témiscamingue county, and the Federal Zinc Co. Ltd., whose property is situated in the township of Lemieux, Gaspé county.

In the table of mineral productions on page 8 of the general report it will be seen that the total of the wages paid during the year was $6,300,204. This is a decrease of 36%. In the previous year the sum paid for wages amounted to $9,820,-413. The workmen in mines received $3,444,336 and those in the quarries $2,855,868, as against, $5,699,002 and $4,121,339 respectively for the preceding years.

The average wages in the mines and quarries was $1320 in 1921. This is a very small decrease from the previous year. But about the end of the year the workmen's wages were considerable reduced in the asbestos mines : from 42½ cents per hour they dropped to 25 cents. So that it may be foreseen that for the coming year there will be a great decrease in the cost price of mineral substances. The same decrease it noted in the wages of the workmen employed in quarries remote from the populated centres :

This should bring about a reduction in the selling price of building materials. But it must be observed that unskilled labourers were the only ones who received lower wages last year ; the skilled workmen, those with special capacities for their work received as much as in prosperous years.

There are no strikes to record in the mines and quarries of the Province. But during the last days of November there was, at Thetford mines, a noisy demonstration by a group of unemployed to protest againts the suspension of operations in the mines due to the absolute stagnation of the asbestos market. A committee of unemployed workmen and managers of the mines was formed and

an amicable understanding was arrived at. To carry out this arrangement, a register of the unemployed was opened in all the mines, each one taking charge of its own employees. Most of the companies gave employment to part of their regular staff. Very little mining work was done. These men were employed at dead work such as repairing, cleaning, remodeling and development work as removal of the overburden around the open pits etc, etc.

Table III shows that in 1921 the mine and quarry operators reported to the Bureau of Mines 213 serious accidents. 12 of which were fatal. This number is proportionately inferior to that of last year. Reduced to a common denominator of 1000 300-day workers the number of accidents is 44.6 while it was 47.3 in 1920 and 48.3 in 1919.

The tables and explanatory notes constituting the subject of this report are based on the two lists accompanying it. The first gives a summary of the series of fatal accidents ; the second comprises those that did not result in loss of life, but were so severe that the victim could not go back to work for a period of ten days of more. These are the accidents with the Bureau of Mines considers serious and which operators of mines and quarries are obliged to report within the shortest delay possible under pain of the penalties provided by law.

Article 2213a, of the Mining Law reads as follows : "If while a mine or quarry is being worked, an accident takes place resulting in loss of life or serious injury, the person working the same or his representative at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known.

Every person not complying with the requirements of this article, shall be liable to the penalties provided in article 2207."

ACCIDENTS IN MINES, QUARRIES AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC FOR 1921

	Fatal		Non-fatal		Totals	
	No.	%	No.	%	No.	%
Mines :						
Underground. .	2	0.9	16	7.5	18	8.4
Open pits. . .	5	2.4	114	53.5	119	55.9
Surface. . . .	—	—	24	11.3	24	11.3
	7	3.3	154	72.3	161	75.6
Quarries :						
In pits. . . .	4	1.9	8	3.8	12	5.7
Surface. . . .	1	0.4	4	1.9	5	2.3
	5	2.3	12	5.7	17	8.0
Annexed plants :						
Concentrators.	—	—	27	12.6	27	12.6
Shops.	—	—	8	3.8	8	3.8
Power plants.	—	—	—	—	—	—
	0	0	35	16.4	35	16.4
Totals. . .	12	5.6	201	94.4	213	100.%

There were 12 fatal accidents in the mines and quarries during the year 1921. This is an average of 2.51 per 1000-300-day workers. In the previous years it was 0.6, 4.5, 1.67 and 3.36 respectively for 1917, 1918, 1919 and 1920. The index number for the past year is slightly below the average of 2.53 for the four preceding years. In the mines properly speaking, the average fatal accidents was 3.02 per thousand 300-day-workers, while in the stone quarries, where the work is much easier, the average was 2.03. Although these index numbers are not high and will bear comparison with statistics published in other mining cen-

tres, the operators must insist upon their subordinates and foremen instructing their workmen of safety measures against accidents. This is a duty which they must impose upon themselves, first of all, because it insures better operation, and secondly because the management is bound to protect the lives and health of the men in their employ.

The Bureau of Mines publishes the tables accompanying this report for the information of the mine operators, their superintendents and their foremen. They will find important information regarding the most frequent accidents and also some suggestions regarding the best means to be taken to avoid these same accidents. In the United States great progress has been made in reducing the number of accidents in many industries, through a study of similar statistics and of the methods of prevention, by the education of the workmen, by means of lectures or otherwise, on the duty they must impose for themselves and their families of being prudent in their work and to not expose themselves to danger and to know how to eliminate causes of accidents. One of the largest mining company in this Province has organized a service of accident prevention from which, they obtained good results. This is the Canadian Johns Manville Company, Limited, whose mining properties are located at Asbestos near Danville in the county of Richmond. The safety department is under the charge of a safety engineer. His duties consist in watching the methods of work and to have removed all risks which may cause accidents. He must also warn the workmen of the dangers inherent to their work and explain to them the means to be taken to avoid them. This service also has a hospital-ward directed by a trained nurse.

Table IV subdivides the accidents according as to whether they happened underground, in open cast pits, in the yards of the mines or quarries, or in the surface buildings. It shows the number of fatal and non-fatal accidents of each group as well as the percentage with regard to the total of the accidents. By comparing this table with the corresponding one in last year's report

it well be seen that there has been proportionately fewer fatal accidents in mines and more in the quarries.

In these statistics, no account is taken of accidents in working lime kilns, in cement mills after the crushing stage, nor in kilns where bricks are burned. Such operations belong to the class of manufacturing industries, as do also the accidents that occur in them.

TABLE V

ANALYSIS OF FATAL ACCIDENTS IN MINES, QUARRIES, ANNEXED PLANTS IN THE IN THE PROVINCE OF QUEBEC FOR 1921.

	Underground	Open pits	Surface	Total	
				No.	%
Mines :					
Falls of rock.	2	4		6	85.7
Cable Derrick.		1		1	14.3
	2	5		7	100 %
Quarries :					
Derricks.		1	1	2	40.
Explosives.		2		2	40.
Electricity.			1	1	20.
		3	2	5	100 %

Tables V and VI give in detail the causes of fatal and non-fatal accidents. They mention the chief causes of accidents and will serve as a guide for those who are interested in reducing the chances of accidents at their plant. If one examines these tables with the corresponding ones in the reports of the past years, it will be seen that the percentage of accidents, attributable to the various causes enumerated is about the same. This

therefore means that the causes of accidents are constant ; and that the struggle for reducing the number of accidents must above all bear on these points. In the underground work, it is necessary to watch and carefully clean the roof and walls of the working places and mainways. In working in open cast pits of great depth the danger of rocks falling from the high walls is ever present and, to secure the safety of the workmen, it is necessary to appoint gangs to see to the periodical scaling of the walls. In quarries the stones, after being broken with explosives, form a slope or talus and men are employed to load the stone or ore into derrick boxes. The greatest danger of this work lies in the angle at which the stone lies. It oftens happens that, in order to go faster the workmen forget the danger to which they expose themselves and undercut the talus.

The system of haulage by railway takes year after year greater importance. The powerful locomotives, the speed of the trains, the switching, the loading and unloading of the cars are so many possible causes of accidents.

In the asbestos mines are systems of cable-derricks for hoisting out the rock. The chief dangers of these installations consist in the loading of the derrick-boxes at the bottom of the pit and in the hoisting and carrying of them over the head of the workmen.

TABLE VI

ANALYSIS OF NON-FATAL ACCIDENTS IN MINES, QUARRIES, AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC FOR 1921.

	Under-ground	Open pits	Surface	Total No.	Total %
Mines :					
Falls and slides of rock	3	50	3	56	36.4
Railroads	3	14	7	24	15.6
Cable-derricks		22		22	14.3
Falls	1	6	3	10	6.5
Miscellaneous		3	5	8	5.2
Drilling	3	3	1	7	4.6
Steamshovels		6		6	3.9
Explosives	3	1	1	5	3.2
Cranes		5		5	3.2
Hammering rock		2	1	3	1.9
Falls of objects		1	1	2	1.3
Shaft	2			2	1.3
Derrick			1	1	0.7
Aerial Tramway			1	1	0.7
Timbering	1			1	0.6
Scalded		1		1	0.6
		114	24	154	100 %
Quarries :					
Falls of rock		2		2	16.7
Explosives		2		2	16.7
Railroads			2	2	16.7
Falls		1	1	2	16.7
Hammering rock		2		2	16.6
Drilling		1		1	8.3
Miscellaneous			1	1	8.3
	16	8		12	100 %
Annexed Plants :	Concen-trators	Repair Shops	Power Plants	Total No.	Total %
Machinery	4	5		9	25.7
Gearing & Shafting	7			7	20.0
Falls	5	1		6	17.2
Miscellaneous	3	2		5	14.3
Falls of objects	3			3	8.6
Falls of rock	2			2	5.7
Bagging	1			1	2.9
Burns	1			1	2.8
Electricity	1			1	2.8
	27	8		35	100 %

The very nature of explosives makes them dangerous to handle ; therefore it is necessary that they be entrusted only to experienced persons. In winter-time dynamite should be thawed before being used. This cannot be done carelessly or at haphazard. The rules established by experience must be followed. The presence of open fire near dynamite is always a source of danger, as may be seen by the recent explosion of the building for thawing out dynamite on the property of the St. Maurice Lime Works at St. Louis de France, in the county of Champlain. In a wooden building the sticks were placed on shelves and the heat required for thawing them came from a stove in the middle. For some unknown reason the building caught fire and blew up. Fortunately there was no one in the place at that moment. When it is necessary to thaw daily a quantity of more than fifty pounds of dynamite, a special building should be supplied which would be heated by indirect heat ; that is to say that the source of heat should be at least 100 feet away. The surest method is to heat with hot water circulating in coils. This method is the one most in favour in the asbestos mines. It has been described at length in the Annual Report on Mining Operations of the year 1918.

A second cause of accidents through explosives is drilling in holes that have missed fire ; that is to say holes in which a little dynamite remains after the mines have been fired. Many accidents of this kind happen in drilling into large blocks in asbestos mines and in stone quarries.

In the annexed plants, such as those for crushing, concentration and separation repair-shops and power plants, one fourth of the accidents are attributed to moving parts of machinery. It is therefore necessary that these be provided with good guards. The shafting, pullies, belting and gearings are so many sources of accidents from which the workmen must be protected. Most

Table VII

Accidents by Rock Falls and Slides, by month, during 1921.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Non-Fatal													
Underground.	—	—	—	1	—	2	—	—	—	—	—	—	3
Open Pits.	10	9	5	5	—	1	5	2	5	1	1	6	50
Quarries.	—	1	—	—	—	1	—	—	—	—	—	—	2
Fatal													
Underground.	—	—	1	—	—	1	—	—	—	—	—	—	2
Open Pits.	1	1	1	—	—	—	—	—	—	—	1	—	4
Quarries.	—	—	—	—	—	—	—	—	—	—	—	—	0
	11	11	7	6	—	5	5	2	5	1	2	6	61

of these accidents occur when a workman is oiling. No oiling should be done when machinery is in motion, all bearings should be supplied with oil-cups of sufficient capacity to last ten hours. The cups to be filled only when the machinery is brought at a standstill between shifts.

MINES, QUARRIES AND ANNEXED BUILDINGS IN THE PROVINCE OF QUEBEC

FATAL ACCIDENTS DURING THE YEAR 1921

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Accident
1	Jan. 19	Asbestos Corporation of Canada Ltd., King mine, Thetford. . .	Guido Ziraldo. . .	23	Labourer. . . .	Was crushed by fall of a block of frozen earth in open cast pit.
2	Fev. 2	Asbestos Corporation of Canada Ltd., Beaver mine, Thetford. .	Calixte Boudreault. .	26	Labourer. . . .	Killed by rock falling from cable-derrick box in open cast pit.
3	Fev. 5	The Pennington Asbestos Co., Robertson.	Wilfrid Lessard. . .	14	Bell-boy. . . .	Killed in pit by fall of rock from side of pit.
4	Mar. 25	Asbestos Corporation of Canada Ltd., King mine, Thetford. .	Jos. Labbé. . . .	21	Driller. . . .	Struck by piece of frozen earth detached from side of pit.
5	Mar. 30	Consolidated Asbestos Ltd., Thetford.	M. Todoscink. . . .	25	Shoveller. . .	While loading a car underground at a chute a rush of rock hit the 15-inch pole : The impact broke the 56-pound rail holding it at one end. The rock went through and jammed the deceased against the car before he could get away.
6	Apr. 23	Standard Lime Company Ltd., Joliette quarry.	Wilfrid Soulière. .	41	Electrician. . .	Grasped a live wire carrying a load of 2200 volts to a motor. Electrocuted.
7	June 1	Bell Asbestos Mines, Thetford. .	Thomas Collette. .	—	Tunnelman. . .	Big stones and lumps of clay bruised victim, when roof of rock tunnel caved-in.
8	Aug. 10	Fireproof Crushed Stone Co., Montreal.	Narcisse Paquin. . .	—	Quarryman. .	Killed by a premature blast when loading with dynamite a chambered deep well drilled hole.
9	" "	" " "	Joseph Bouchard. .	—	Quarryman. . .	Killed by a premature blast when loading with dynamite a chambered deep well drilled hole.
10	Aug. 16	The Villeray Quarry Co. Ltd., Montreal.	Aristide Dulong. .	63	Stone-cutter. .	The boom of a hand derrick fell on him while at work cutting stone.
11	Aug. 24	" " "	J. di Michaele. . .	32	Driller. . . .	While at work in bottom of quarry he was killed by a rock falling from the box of a derrick.
12	Nov. 30	Quebec Asbestos Corporation, E. Broughton.	Alfred Vachon. . .	—	Driller. . . .	While drilling in face of open cast pit a rock fell on him.

DESCRIPTION OF FATAL ACCIDENTS

On the 19th of January—Guido Ziraldo, 23 years of age, employed in the King Mines, property of the Asbestos Corporation of Canada, Limited, was killed by a fall of rock. About an hour and a half after midnight, the victim was at the bottom of the pit occupied in chaining a stone that was to be lifted by a cable-derrick. About fifty feet away there was a block consisting of earth and of small pieces of stone frozen together. The witnesses who were heard at the inquest and who had seen the block, were unanimous that its position showed every appearence of security. They said that the block slid slowly and then turned over. When the stone toppled over Ziraldo had his back turned to the block and was bending over the stone around which he was putting the chain ; his position dit not allow him to see the stone start and to get out of the way quick enough to escape from being crushed between the falling stone and the one to which he was fastening the chain.

Verdict : accidental death.

February 2nd—Calixte Boudreault, 26 years of age, was killed by a stone that fell from a cable derrick-box loaded with stone which was being hoisted from the bottom of the open cast pit at the Beaver Mine at Thetford Mines. According to the evidence given at the coroner's inquest, it would appear that the loading of the derrick boxes was done by contract and that, while the box was being hoisted, workmen were working under it notwithstanding the orders of the superintendent of the mine. When the box reached the cable it struck the derrick violently ; pieces of stone fell out of the box and one of these pieces struck Boudreault on the right side of his head. On examining the body the physician found a large cut and also that the skull and half of the brain were crushed. About one half of the skull was fractured.

Verdict accidental death.

On the 5th of February.—Wilbrod Lessard, aged 13 years and three months was killed by stone falling to the bottom of an

open cast pit of the Pennington Asbestos Company. While the foreman was absent for a short time, young Lessard went down to the bottom of the pit and helped the worken to load stones into a cable-derrick box. The box was at the foot of a vertical face. A few minutes after four o'clock in the afternoon, stones began to fall from the upper part of the wall which, at that spot measured about 110 feet in height ; notwithstanding the foreman's call, young Lessard had not time to get away. He was struck on the head by a piece of stone and died at once. At the examination of the body the physician found a complete fracture of the skull with the loss of bony substance. The witnesses at the inquest said that that part of the wall had been cleared of all detached pieces the day before.

Verdict accidental death.

On the 25th of March.—About two o'clock in the afternoon Joseph Labbé, 20 years of age, a drill-runner, was at the bottom of the open-cast pit at the King mine, sitting close to his machine and engaged in turning the handle, when a piece of frozen earth, weighing about two hundred pounds fell from the sloping wall and rolled down from a height of 150 feet. As it passed it struck Labbé on his side, causing internal lesions which produced fatal intestinal hemorrhage. He died before arriving at the hospital in Thetford.

The wall from which this piece of stone and earth fell, had a slope of 60 degrees and was considered as being in a secure condition. When the accident happened there were only four miners at the bottom of the open cast pit. Some who saw the stone fall called out, but the noise of the machine prevented, the victim from hearing them.

Verdict accidental death.

On the 30th of March—Mike Toduscink, a Roumanian, unmarried, age 25 years and a trammer in the Thetford mine of the Consolidated Asbestos, Limited was killed by the breaking of the frame of a chute.

This man's work consisted in lifting the log which closed

the opening of the chute, when the cars were to be filled. At the moment of the accident he was on a platform on the side of the opening and another workman was on the opposite side. Suddenly there was a drop in the raise and a large piece of rock struck the log, broke the rail supporting it on the side where Toduscink was, and wedged the victim against the opposite wall. Compression on his stomach caused asphyxia.

At the moment of the accident there was rock in the lower part of the chute. The only explanation of the accident is that, in the vertical part of the chute, the rocks had formed an arch causing a jam at an appreciable height. While from the bottom rock was being taken out, it left a void, and, for some reason so far unknown, the arch broke and the rock falling from a great height struck the lower part, with such violence that one of the 56 lb rails on which was resting the log was broken, allowing the rock to pass through the opening and to crush the victim against the opposite wall of the drift.

An examination of the rail showed no flaw, but it may be that, at the point of rupture, the steel may have been crystallized. The log measured 14 inches in thickness and was not broken. The lower part of the chute is incline to 30 degrees for the first fifteen feet and measures 5 x 7 feet. The vertical part is not timbered and measures 5 x 10 feet.

The medical examination revealed no fracture. Death was no doubt due to asphyxiation by the crushing in of the chest. The victim died a few minutes after he had been taken out.

Verdict accidental death.

On the 23rd of April—Wilfrid Soulière, 41 years of age, an electrician in the employ of the Standard Lime Co. Limited, at Joliette, was electrocuted by taking in his hand a live wire of 2200 volts.

Soulière was talking to the manager of the company near an electric motor. The latter called the electrician's attention to the fact that it was not safe to be too close to the high voltage wire. Soulière ignoring this advice, took in his hand the wire

carrying the current. Death was almost instantaneous.

On the first of June—Thomas Collette, a miner, was fatally wounded while driving a tunnel in the Bell mine at Thetford. He died of his wound on the 14th of the same month.

Collette with two other miners, on the night of the 31st of May and first of June, was removing rock from a previous blasting in the face of the tunnel which was being driven. This tunnel starts from the west corner of the open cast pit and, when finished, will come out at the surface to the west of the mill. It is inclined to ten degrees. The place where the accident happened is about 450 feet from the lower portal. At this place the walls of the tunnel are of solid rock ; but the roof, over a length of 15 feet consist of clay with boulders which resist the pick axe to some degree. In order to protect the workmen against the possibility of falls of rock, the Company had large, timber sets built. These sets consist in square timbers, 12 inches, spaced at 30 inches centre to centre, on which there are planks six inches thick. It is said that the whole space between the lagging and the roof is filled with pieces of well-wedged timber. The beams are 12 feet long and are supported by large post. About two o'clock in the morning, the hour of the accident, the men were shovelling, under the timber, the stones from the last blast that had been fired, when, apparently, without warning, the two beams nearest to the face broke in the centre burying the workmen under an avalanche of earth and small stones. Two came out unharmed, while Thomas Collette was seriously wounded and remained pinned under the blocks of wood, covered with earth and a large rock weighing seven tons. It took four hours of hard work by a gang of workmen to remove the rock, to clear away the earth and to rescue Collette from his position. Notwithstanding that the beams protected the upper part of his body, he received fatal injuries ; amongst others compound fractures of the bones of the hips, crushing of the organs of the pelvis and complete and compound fractures of the right leg. These wounds caused his death.

Verdict accidental death.

On the 10th of August,—Narcisse Paquin, aged 45 years, and Joseph Bouchard aged 16 years were killed and Arthur Longtin seriously wounded by the premature explosion of a charge of dynamite in the quarry of the Fireproof Crushed Stone Co, Limited, on Masson street Montreal.

This quarry was opened in a sheet of tinguaite rock 39 feet thick. This rock is known in the trade under the name of "banc rouge". The method of quarrying consists in breaking the rock with heavy charges of dynamite put in holes forty feet deep, nine feet apart, bored with a deep well driller. The diameter of the hole is 4½ inches. Before putting in the explosive the hole at the bottom is chambered by two light charges. For this eight cartridges of dynamite are used. Twenty four hours are allowed for cooling before the final charge is put in the hole. It was in doing this work that the accident happened. The party in charge of the loading of the mines consists of three men. To put the dynamite in the hole, every cartridge is slit and is dropped into the hole ; then it is tamped with a wooden rod in order to fill the open spaces. The hole had just been measured and there was fourteen feet of dynamite when, on dropping another stick of dynamite the explosion occurred killing two of the workmen and seriously wounding the third. No explanation was given regarding the cause of the accident. The practice followed is that generally admitted everywhere. The dynamite cartridges were in good order, nobody was smoking, 24 hours had elapsed after firing the blast intended for enlarging the hole at the bottom. This period of time and the water which always accumulates in those holes should have sufficiently cooled the hole.

The examination of Paquin's body showed that the left arm and shoulder had been torn off and that there were extensive lacerations on the face and on the scalp as well as several fractures on the head. Bouchard was picked up with a fracture of the left hip, many contusions on the front of his body and several lacerations of his face and scalp. Death was instantaneous in both cases.

Verdict accidental death.

The 16th of August—Aristide Dulong, 63 years of age in the employ of the Villeray Quarry, Ltd. Rosaire St. Montreal, was killed by the fall of the boom of a hand derrick.

Two workmen were ordered to put in motion a small stiff-leg derrick worked by hand used in moving stones from the working-floor, when they were ordered by the foreman to raise the boom which at that moment was just over Dulong, a stone-cutter who was working at his own trade on the surface. The foreman himself had thrown the machinery into gear. The two men had just turned the handle of the winch three or four times when the boom fell on Dulong crushing in his chest, fracturing the sternum and also the ribs on both sides.

This derrick had been inspected on the previous day and the slight repairs made which were deemed necessary. After the accident, the derrick was examined and nothing was found to be broken. The only plausible explanation is that the cog had slipped and that the safety catch had dropped down allowing the drum around which was wound the cable holding the boom to run loose.

An elementary precaution to avoid the repetition of such accidents would be to never allow the boom of a derrick to swing over places where men are working.

Verdict accidental death.

On the 24th of August—Giovani di Michaele, Italian, 31 years of age, a drill-runner in the employ of the Villeray Quarry Co., Limited, was killed at the bottom of a quarry by a stone falling from a derrick-box which was being hoisted.

According to the information given by the company, Di Michaele was working at the bottom of the quarry, when the accident happened. While the derrick was in motion a stone fell out of the box from a height of 40 feet and struck him on the head. Death was instantaneous.

As is the case in most quarries, hoisting stones is performed by guy derricks whose mast is held by cables anchored some distance away. The boxes are fastened to the derrick by a cable

running through a movable boom. The work consists in hoisting the box to the height of the surface and then swing the boom to the desired position. It often happens that in so travelling the box covers a rather considerable area of ground and, as the area of the quarry is generally limited, the box passes over the quarrymen working at the bottom. This accident, like the previous one, shows the danger to which the workmen are exposed when working within the circle of the radius of the boom.

On the 4th of December—Alfred Vachon a young man, who was a drill-runner in the employ of the Quebec Asbestos Corporation at East Boroughton, was instantly killed by a fall of stone.

At the moment of the accident this man was working at the bottom of an open cast pit, drilling holes in large pieces of rock on a slope in front of the steamer shovel. These blocks of stone came from a previous blast. Vachon was about in the middle of the talus when a heavy stone, weighing two tons fell down from just above where he was standing. He had no time to get out of the way. In falling, the stone crushed his head. He was dead when picked up.

As the Bureau of Mines was not notified of the date of the inquest it was not represented when it was held.

Mines, Quarries and Annexed Plants in the Province of Quebec

NON-FATAL ACCIDENTS

DURING THE YEAR 1921

MINES, QUARRIES AND ANNEXED BUILDINGS IN THE PROVINCE OF QUEBEC

NON-FATAL ACCIDENTS DURING THE YEAR 1921

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of wound and cause of accident
1	Jan. 2	Consolidated Asbestos Ltd.....	H. Giroux.....	58	Yardman.....	Right elbow sprained when hit by rock while loading dumpcart.
2	Jan. 4	Asbestos Corporation of Canada Ltd., King mine.....	Aug. Savoie.....	18	Millman.....	Left shoulder bruised when struck by broken belt in mill.
3	Jan. 4	Asbestos Corporation of Canada Ltd., B-C. mine.....	Alex. Paradis.....	—	Labourer.....	Left knee bruised when falling on his knees in open cast pit.
4	Jan. 8	Asbestos Corporation of Canada Ltd., Beaver mine	J. Châteauneuf.....	18	Labourer.	Left jaw broken, was hit by a cable-derrick box in motion and thrown on a rock.
5	Jan. 8	Asbestos Corporation of Canada Ltd., Beaver mine.....	E. Théberge.....	36	Labourer.	Chest bruised when hit by a cable-derrick box in motion.
6	Jan. 10	Black Lake Asbestos & Chrome Co. Ltd.....	Louis Caron.....	30	Tinsmith.....	Infection set in wound after he cut his finger on a piece of sheet iron.
7	Jan. 10	Asbestos Corporation of Canada Ltd., King mine.....	Art. Mailhiot.....	42	Carpenter.....	Fifth fiinger of left hand cut by circular saw.
8	Jan. 11	Canadian Johns-Manville Co. Ltd.	Fred. Gendron.....	25	Tinsmith.....	Sprained and bruised left ankle when block of wood fell in mill.
9	Jan. 12	Asbestos Corporation of Canada Ltd., King mine.....	Ls. Shinks.....	25	Labourer.....	Left leg injured by piece of rock, while at work in open cast pit.
10	Jan. 12	Asbestos Corporation of Canada Ltd., Beaver mine.....	Adolphe St-Cyr.....	32	Foreman.....	Left ankle broken, was struck by piece of rock while at work in open cast pit.
11	Jan. 13	Canadian Johns-Manville Co. Ltd.	Camille Morin.....	22	Brakeman.....	Sprain of left elbow and left thumb, stepped and fell while working on locomotive in open cast pit.
12	Jan. 14	Black Lake Asbestos & Chrome Co. Ltd.....	Alph. Lachance.....	36	Driller.....	Scalp wound and contusion of the brain : while connecting some pipes on the edge of the pit, he slipped and fell a distance of about 35 feet, landing on his head.
13	Jan. 14	Asbestos Corporation of Canada Ltd., Beaver mine.....	W. Bertrand.....	19	Labourer.....	Rock sprained when struck by stone in open cast pit.
14	Jan. 14	Black Lake Asbestos & Chrome Co. Ltd.....	France Gagnon.....	50	Millman.....	Left side bruised and rib fractured, while feeding a crushed in mill he slipped on an iron plate and fell against the crusher.
15	Jan. 15	Asbestos Corporation of Canada Ltd., King mine.....	Nap. Vachon.....	20	Labourer.....	Right leg injured by rolling stone in open cast pit.
16	Jan. 15	Canadian Johns-Manville Co. Ltd.	Eugène Dubois.....	21	Brakeman.....	Laceration of a finger of right hand when caught between car and bar while dumping.

17	Jan. 18	Asbestos Corporation of Canada Ltd., King mine	Pierre Giguère.....	18	Labourer.....	Right foot bruised by trap door falling on his foot in yard.
18	Jan. 18	Asbestos Corporation of Canada Ltd., King mine.....	Auguste Bois.....	48	Labourer.....	Left hand finger broken when piece of rock struck it, in open cast pit.
19	Jan. 19	Canadian Johns-Manville Co. Ltd.	Wilfrid Côté.....	41	Cobber.....	Sprain of right hand when falling on ice on his way to office of company.
20	Jan. 20	Canadian Johns-Manville Co. Ltd.	Alfred Guay.....	25	Steam shovel man.....	Dislocation of left shoulder ; fell on rocks.
21	Jan. 21	Asbestos Corporation of Canada Ltd., King mine.....	Ulric Labarre.....	26	Labourer.....	Right hand bruised by falling rock in open cast pit.
22	Jan. 21	Consolidated Asbestos Ltd.....	D. Boulanger.....	38	Oiler.....	Sprained right knee while picking up a piece of iron in mill.
23	Jan. 21	Consolidated Asbestos Ltd .	A. Maynard.....	30	Driller.....	While tightening a nut on a drill underground he fell on the drill and broke one of his right ribs.
24		Asbestos Corporation of Canada Ltd., Beaver mine.....	W. Benard.....	19	Labourer.....	Wound to right eye, piece of asbestos flaw on his eye when blowing a drilled hole with the air hose.
25	Jan. 22	Asbestos Corporation of Canada B-C mine.....	Pierre Boucher.....	32	Labourer.....	Chest and arm bruised when struck by piece of frozen earth in open cast pit.
26	Jan. 26	Bell Asbestos Mines.	Albert Lemieux. . .	—	Miner.	Toes bruised when caught between body of the car on which he was standing and a crane-box he was dumping.
27	Jan. 27	Bell Asbestos Mines.	Fred Arsenault. . .	—	Driller.	Left leg bruised when caught between rocks which rolled down from jam.
28	Jan. 28	Weedon Mining Company Ltd. .	Pet. Pittao.	41	Miner.	Coming up a winze, his foot slipped and hurt left knee on a wall plate.
29	Jan. 28	Asbestos Corporation of Canada Ltd., B-C mine.	S. Bédard.	22	Labourer. . . .	Fingers of left hand bruised when stone fell.
30	Jan. 31	Asbestos Corporation of Canada Ltd., B-C mine.	G. Ceehire.	31	Labourer. . .	Was struck by stone falling from side of pit inflecting scalp wound.
31	Jan. 31	Canadian Johns-Manville Co. Ltd.	Wilfrid Pinard. . .	23	Brakeman. . .	Compound fracture of fifth toe and extensive laceration of left foot, when caught in some way by locomotive.
32	Fev. 1	Canadian Johns-Manville Co. Ltd.	Amédée Pelletier. .	22	Steam Shovel man.	Sprain of right foot when man fell from boom of steam shovel while trying to lift cover.
33	Fev. 2	Consolidated Asbestos Ltd. . .	G. Lehlond.	57	Yardman. . . .	Right hand sprained while shovelling in yard.
34	Fev. 4	Asbestos Corporation of Canada Ltd., B-C mine.	Wilf. Dussault. . .	—	Labourer. . . .	Right foot scalded when he dropped steam hose.
35	Fev. 5	Asbestos Corporation of Canada Ltd., King mine.	Nap. Laplante. . . .	31	Labourer. . . .	Pulling on a chain he complained of pain at stomach.
36	Fev. 5	Consolidated Asbestos Ltd. . . .	O. Morissette. . . .	41	Oiler.	Was carrying a heavy shaft in mill when he sprained his back.
37	Fev. 5	Consolidated Asbestos Ltd. . . .	Donat Pelletier. . .	—	Machinist. . .	Was handling a piece of steel in machine shop, when a sliver got into a finger of left hand causing blood poisoning.

NON-FATAL ACCIDENTS 1921

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Accident
38	Fev. 7	Asbestos Corporation of Canada Ltd., King mine.	Phi. Hughes.	39	Labourer.	Was struck on right leg by stone rolling from jam.
39	Fev. 10	John Quinlan & Co, quarry.	J. B. Audet.	—	Quarryman.	Man was working in pit of quarry with hammer, when a stone accidentally slid down the bank and crushed his thumb against another stone.
40	Fev. 10	Asbestos Corporation of Canada Ltd., Beaver mine.	P. Shink.	37	Labourer.	Struck on right wrist by stone falling from jam.
41	Fev. 11	Consolidated Asbestos Ltd.	V. Patchille.	30	Driller.	Right elbow bruised when rotating steel broke and slipped out of hole, while drilling in raise
42	Fev. 12	Asbestos Corporation of Canada Ltd., King mine.	Jos. McLee.	27	Labourer.	Finger of left hand bruised when struck by piece of rock.
43	Fev. 12	Consolidated Asbestos Ltd.	L. Scandella.	32	Driller.	Right side injured, when he fell off skip.
44	Fev. 12	Asbestos Corporation of Canada Ltd., B-C mine.	Eug. Primovera.	—	Labourer.	Left hand bruised when struck by falling stone.
45	Fev. 16	The North American Magnesite Producers Ltd.	Russel Crooks.	18	Labourer.	Small toe of left foot fractured and crushed when ore car ran over foot.
46	Fev. 18	Canadian Johns-Manville Co. Ltd.	Jacques Charland.	27	Steam Shovel. operator.	While repairing parts on steam shovel finger caught in gearing.
47	Fev. 18	Asbestos Corporation of Canada Ltd., King mine.	Odilon Bergeron.	31	Labourer.	Finger of left hand bruised when struck by piece of rock falling from jam.
48	Fev. 18	Asbestos Corporation of Canada Ltd., King mine.	Xavier Bilodeau.	18	Labourer.	Right leg broken ; struck by rock which rolled from jam.
49	Fev. 19	Asbestos Corporation of Canada Ltd., King mine.	Arthur Caron.	29	Labourer.	Right foot injured ; struck by rock falling from jam.
50	Fev. 22	Asbestos Corporation of Canada Ltd., King mine.	Art. Pageau.	29	Labourer.	Struck in left eye by small stone falling from jam.
51	Fev. 23	Asbestos Corporation of Canada Ltd., King mine.	Thom Fecteau.	18	Carter.	Pain in stomach when squeezed between cart and post of bridge when passing underneath bridge.
52	Fev. 25	Consolidated Asbestos Ltd.	A. Maheu.	18	Driller.	Nose bruised ; while handling a drill at glory holes he fell, and struck face on some rock.
53	Fev. 25	Quebec Asbestos Corporation, mine No 2.	Treffié Auclair.	21	Oiler.	Left arm badly bruised when caught in gearing of bucket elevator in mill.
54	Fev. 26	Asbestos Corporation of Canada Ltd., King mine.	Johnny Labarre.	44	Labourer.	Left foot fracture when rock rolled from jam in open cast pit.

55	Fev. 26	Asbestos Corporation of Canada Ltd., B-C mine.	Ant. Sylvestre. . . .	—	Labourer. . . .	Left foot bruised when foot caught betwee. rock and cable-derrick box in open cast pit.
56	Fev. 28	Quebec Asbestos Corporation, mine No 1.	Joseph Gagné. . . .	20	Oiler.	Left leg broken, when pants caught between belt and drum while standing on frame of conveyor belt at top of waste dump, oiling rear end.
57	Mar. 1	Asbestos Corporation of Canada Ltd., King mine.	G. Wittbold.	31	Labourer. . . .	Left leg bruised when rock fell on it.
58	Mar. 1	Consolidated Asbestos Ltd. . .	Pierre Roy.	—	Labourer. . .	Right thumb dislocated when he fell while running away from a block hole he had just lit underground.
59	Mar. 1	Asbestos Corporation of Canada Ltd., King mine.	Phil. Martin. . . .	18	Labourer. . . .	Fractures at two places on left leg when struck by rock rolling from jam.
60	Mar. 3	O. Martineau & fils Ltée, Papineau quarry.	F. Paré.	50	Driller.	Face and hands burned by explosion of dynamite when he dropped a drill steel in a missed hole.
61	Mar. 3	Asbestos Corporation of Canada Ltd., Beaver mine.	Jos. Jolicoeur. . . .	22	Labourer. . . .	Right eye injured by piece of rock which flew into his eye.
62	Mar. 4	Bell Asbestos Mines.	Paul Goulet.	—	Labourer. . . .	Left shoulder bruised, when thrown on pile of rock while dumping a lorry.
63	Mar. 4	Consolidated Asbestos Ltd. . . .	Henri Nadeau. . . .	—	Electrician. . .	While repairing a controller he had face badly burned by a short circuit.
64	Mar 7	Consolidated Asbestos Ltd. . . .	Adolphe Barnabé. .	—	Labourer. . . .	Right leg cut and bruised by old cable which twisted around it while barring loose rocks around which was frozen this cable.
65		Asbestos Corporation of Canada Ltd., King mine.	Alfred Richard. . .	23	Yardman. . . .	Pain felt in stomach when moving bags of asbestos fibre.
66	Mar. 10	Asbestos Corporation of Canada Ltd., B-C mine.	Phil. Charland. . .	—	Labourer. . . .	Stone in falling from jam bruised toe of right foot.
67	Mar. 11	Asbestos Corporation of Canada Ltd., King mine.	Achille Poulin. . .	—	Labourer. . . .	Piece of rock fell on finger of right hand bruising it.
68	Mar. 11	Consolidated Asbestos Ltd. . . .	Alfred Lavallée. . .	20	Ore sorter. . .	Stepped on a loose rock and sprained his left foot.
69	Mar. 11	Asbestos Corporation of Canada Ltd., B-C mine.	Siméon Bédard. . .	23	Labourer. . . .	Had thumb bruised between rock and cable derrick box in open cast pit.
70	Mar. 12	Asbestos Corporation of Canada Ltd., Beaver mine.	E. Bertrand. . . .	20	Labourer. . . .	Was struck by piece of rock, cut on scalp.
71	Mar. 15	Asbestos Corporation of Canada Ltd., Beaver mine.	Alp. Jolin.	33	Labourer. . . .	Fingers crushed between two heavy stones, in open cast pit.
72	Mar. 19	Canadian Johns-Manville Co. Ltd.	Frank Demers. . . .	56	Trackman. . .	Struck on left thigh by a railroad tie he was moving in open cast pit causing abrasion and extensive contusion.
73	Mar. 21	Asbestos Corporation of Canada Ltd., Beaver mine.	Nap. Laliberté. . . .	46	Mill hand. . .	Fingers of right of hand cut when caught between rope and pulley block in mill.
74	Mar. 21	Consolidated Asbestos Ltd. . .	Raphael Gauthier. .	21	Fireman. . . .	Face and right hand burned by explosion while lighting a fire in dryer.

NON-FATAL ACCIDENTS 1921

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Accident
75	Mar. 24	Quebec Asbestos Corporation, mine No 2.	Joseph Lessard. . .	23	Driller. . . .	Going down into open cast pit he slipped and fell, dislocating left wrist.
76	Mar. 24	Asbestos Corporation of Canada, Ltd., B-C mine.	Wilf. Ouellet. . . .	—	Labourer. . . .	Fingers bruised caught between drill and stones in open cast pit.
77	Mar. 26	Asbestos Corporation of Canada, Ltd., King mine.	Nap. Mercier. . . .	33	Labourer. . . .	Deep cut on of scalp when stone fell on his head in crushing mill.
78	Mar. 26	Consolidated Asbestos, Ltd. . .	Art. Dubuc.	20	Oiler.	Chest bruised ; while handling bags in the mill with a winch the handle came back, striking him on the chest.
79	Mar. 30	Canadian Johns-Manville Co. Ltd.	Vincent Gagniers. .	35	Driller. . . .	While drilling into a boulder in open cast pit he hit a missed hole. The explosion caused a number of small fragments of rock to lodge under the skin of face, hands and right leg.
80	Apr. 2	Bell Asbestos Mines.	W. Vachon.	—	Brakeman. . .	While shunting cars on rock dump, he jumped off a car and twisted his right foot.
81	Apr. 2	Asbestos Corporation of Canada Ltd., Beaver mine.	Art. Laliberté. . .	23	Labourer. . . .	Fingers bruised when rock struck his hand.
82	Apr. 2	Asbestos Corporation of Canada Ltd., King mine.	Jos. Vachon. . . .	—	Labourer. . . .	Stone falling from the jam struck a crow bar he was holding and the shock fractured right wrist.
83	Apr.	Canadian Johns-Manville Co. Ltd.	Tél. Turgeon. . . .	50	Trackman. . .	In an attempt to straighten a bent spike for driving into tie, he placed it on a rail and struck it with hammer. The spike flew offrail striking him on the skin, inflicting contusion and abrasion of skin.
84	Apr. 8	Asbestos Corporation of Canada Ltd., King mine.	Rosaire Huard. . . .	—	Labourer. . . .	Right foot fractured when piece of rock on it.
85	Apr. 8	Asbestos Corporation of Canada Ltd., King mine.	Léo Nadeau. . . .	—	Labourer. . . .	Left foot bruised when rock rolled over it.
86	Apr. 11	Asbestos Corporation of Canada Ltd., B-C mine.	Arthur Harton. . .	—	Brakeman. . .	Sprained toe when jumping off car.
87	Apr. 11	Consolidated Asbestos Ltd. . .	Georges Trotter. . .	—	Miner.	While loading car at chute, a rock fell striking injured man on head and legs, inflicting a cut to the scalp and bruising.
88	Apr. 12	Maisonneuve Quarry Co. Ltd. .	H. Arsenault. . . .	45	Quarry man. .	Struck in the eye by piece which flews from the rock he was hammering.

89	Apr. 12	Consolidated Asbestos Ltd. . . .	Zoel Pietro. . . .	—	Miner. . . .	This man with foreman and another were blasting in a chute when apparently, owing to a quick fuse, the dynamite exploded before they had time to get far enough away. The injured had both eyes burned.
90	Apr. 12	Consolidated Asbestos Ltd. . .	R. Livingstone. . .	—	Miner. . . .	This man suffered contusions head and both knees as a result of the same prematured blast.
91	Apr. 20	Bell Asbestos Mines.	Amédée Grosleau. .	—	Track man. . .	Left index finger bruised when caught between end of rail and a tie.
92	Apr. 20	Consolidated Asbestos Ltd. . .	Walter Sherwood. .	—	Brakeman. . .	Left ankle bruised when foot was caught between car and locomotive while coupling underground.
93	Apr. 21	Canadian Johns-Manville Co. Ltd.	Henry Pelchat. . .	24	Brakeman. . .	Crushed thumb between locomotive and steam shovel.
94	Apr. 22	Asbestos Corporation of Canada Ltd., Beaver mine.	Ph. Voyer.	—	Labourer. . .	Left shoulder fractured when struck by stone rolling from jam.
95	Apr. 26	Asbestos Corporation of Canada Ltd., B-C mine.	C. Boissonneault. .	—	Millman. . . .	Rupture of left side when he fell astride on wood work or conveyor.
96	Apr. 27	Asbestos Corporation of Canada Ltd., King mine.	Alf. Lacroix. . . .	—	Labourer. . .	Right foot crushed when struck by loaded cable derrick box in motion in open cast pit.
97	Apr. 27	Consolidated Asbestos Ltd. . .	A. Lessard.	—	Driller. . . .	Cut on head when some rock rolling from side of open cast pit fell on his head.
98	Apr. 28	Consolidated Asbestos Limited. .	D. Pelletier.	—	Yardman. . . .	While putting a ring on dryer with a crow bar latter fell on his left foot fracturing the big toe.
99	Apr. 28	Asbestos Corporation of Canada Ltd., B-C mine.	Th. Matte.	—	Labourer. . .	Stone rolled from jam and fell on his left foot bruising it.
100	Apr. 29	Consolidated Asbestos Limited. .	C. McGee.	—	Mill hand. . .	Left hand bruised when caught by pulley he was cleaning when some one started mill without warning this man.
101	May 2	Asbestos Mines Ltd.	Thomas Grosleau. .	—	Teamster. . .	This man was unloading stones from a waggon when one of them started rolling and fell on his rigth foot crushing the big toe.
102	May 6	Asbestos Corporation of Canada Ltd., B-C mine.	Jos. Vachon.	—	Labourer. . .	Breast and back bruised when caught between lorry and steam-shovel.
103	May 11	Canadian Johns-Manville Co. Ltd.	R. Lavallée. . . .	23	Trackman. . .	Laceration of tip of finger when he dropped rail on finger.
104	May 13	Bell Asbestos Mines.	F. Fabre.	—	Labourer. . .	Finger bruised when it was jammed against edge of crane box when rolling a big stone into it.
105	May 16	Consolidated Asbestos Ltd. . . .	A. Lachance. . . .	—	Miner. . . .	Right side of head both shoulders and chest bruised ; while pulling a car underground, this man was caught between side of car and wall of drift.

NON-FATAL ACCIDENTS 1921

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Accident
106	May 17	The Pennington Asbestos Co. . .	Edgar Côté.	18	Labourer. . . .	While dumping a car of dry rock on surface, his left hand was caught between the skid and iron rail on the car resulting in dislocation of left wrist and fracture of the arm.
107	May 18	Asbestos Corporation of Canada Ltd., B-C mine.	W. Provencal. . . .	—	Hoistman. . . .	Big toe bruised when foot was caught between rod and hoist.
108	May 18	Montreal Crushed Stone Co. Ltd.	Peter Gilmour. . . .	42	Foreman. . . .	This man was using a cold chisel to chip off some metal from a drill bar when a sliver flew into his eye.
109	May 19	National Brick Co. of Laprairie, Ltd.	J. Sheepwash. . . .	—	Trackman. . . .	Big toe of right foot slightly cut and badly bruised when rail he was moving fell on his toes.
110	June 1	Bell Asbestos Mines.	P. Vaillancourt. . .	—	Miner.	Contusion of his back and right shoulder when struck by lump of clay falling from roof of tunnel.
111	June 4	Maple Leaf Asbestos Corporation	W. Lafleur.	—	Labourer. . . .	Scalp wound involving injury to brain, when struck on head by small piece of rock which fell from cable derrick box, the man was standing directly underneath.
112	June 6	Asbestos Corporation of Canada Ltd., King mine.	Art. Vallée.	—	Labourer. . . .	Cut on right leg when struck by piece of rock rolling from jam in open cast pit.
113	June 8	Canada Asbestos & Chrome Co. Ltd.	Alb. Comtois. . . .	—	Labourer. . . .	Finger injured when rock rolled from jam while loading a cable derrick box in open cast pit.
114	June 8	Consolidated Asbestos Ltd. . .	N. Beaulieu. . . .	—	Labourer. . . .	While working in a chute underground some rock fell on his left foot bruising the big toe.
115		Canadian Johns-Manville Co. Ltd.	Alf. Provencher. . .	40	Brakeman. . .	Punctured wound on finger when caught by movable parts while coupling locomotive to steam shovel.
116	June 12	La Cie de Granit de Charlesbourg Ltée.	Omer Touchette. . .	27	Stonecutter. . .	Foot crushed when block of granite he was moving fell on it.
117	June 17	Montreal Crushed Stone Co. Ltd.	Paul Colin.	35	Machinist. . .	Thumb of right hand crushed when caught in hoisting chain while helping to raise a heavy piece of iron.
118	June 23	Asbestos Corporation of Canada Ltd., B-C mine.	Art. Boucher. . . .	—	Labourer. . . .	Finger tip cut off when caught between rock and side of cable derrick box.

119	June 25	Canadian Johns-Manville Co. Ltd.	J. Poisson.	26	Trackman. . .	Carrying heavy material with bar, he strained his back.
120	June 25	Canadian Johns-Manville Co. Ltd.	Ph. Langlois. . . .	10	Steam Shovel Operator. . .	Burns on right foot while at work on steam-shovel in open cast pit.
121	June 29	Standard Lime Co. Ltd., Joliette quarry.	Ad. Desrosiers. . . .	28	Labourer. . . .	Tip of thumb cut off while helping to move a wagon, his thumb caught between rim of wheel and angle steel beam.
122	July 4	Canadian Johns-Manville Co. Ltd.	S. Henry.	26	Driller. . . .	Laceration of fingers when jack slipped and caught fingers.
123	July 5	Consolidated Asbestos Ltd. . . .	S. Levesque. . . .	—	Miner.	Right foot toe bruised when foot jammed, while loading a piece of timber into skip.
124	July 7	Canada Asbestos & Chrome Co. Ltd.	Louis Leclerc. . . .	38	Labourer. . . .	Index finger of right hand crushed between crowbar his hand was holding and side of open cast pit while scaling loose rock.
125	July 8	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	Arthur Jean. . . .	13	Labourer. . . .	Cut to left hand, while scaling a stone swivel his crowbar where his hand was holding it.
126	July 11	Bell Asbestos Mines.	Noel Gilbert. . . .	—	Labourer. . . .	Contusions of his right ribs, when struck by moving cable derrick box.
127	July 11	Montreal Crushed Stone Co. Ltd.	Albert Léonard. . .	—	Labourer. . . .	This man while handling some two-inch pipe slipped and fell cutting end of right hand finger.
128	July 11	Asbestos Corporation of Canada Ltd., King mine.	Alphonse Morin. . .	—	Labourer. . . .	Left foot and leg bruised rock fell from jam and struck him.
129	July 11	Asbestos Corporation of Canada Ltd., B-C mine.	Art. Lafontaine. . .	—	Labourer. . . .	Left foot injured when stone rolled from jam and fell on his foot.
130	July 13	Bell Asbestos Mines.	Honoré Dubois. . . .	35	Labourer. . . .	When throwing heavy stone over the side of the cable derrick box he got his thumb jammed against the edge of the box.
131	July 28	Bell Asbestos Mines.	Nap. Gamache. . .	38	Labourer. . . .	A big stone rolled from a jam over his left foot causing bruises and fracture of big toe.
132	Aug. 1	La Cie de Granit de Charlesbourg Ltée.	Clovis Arcand. . .	33	Stonecutter. . .	Struck in the eye by small piece of rock thrown by a premature blast.
133	Aug. 1	Asbestos Corporation of Canada Ltd., King mine.	Chs. Bisson. . . .	—	Brakeman. . .	Right thumb bruised in coupling cars on surface.
134	Aug. 3	Johnsons' Company, Thetford mine.	O. Vaillancourt. . .	60	Carpenter. . .	While taking off shingles from a roof, a nail hit him in the right eye scratching it severely.
135	Aug. 3	Asbestos Mines Ltd.	Nap. Marcoux. . . .	30	Mason.	Dislocation of shoulder when he struck a beam while running away from fuse he had just lit to explode a charge of dynamite on an old cement block.
136	Aug. 5	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	Au. Gagné.	32	Foreman. . . .	While firing a locomotive a small piece of coal flew into his left eye.
137	Aug. 8	Asbestos Corporation of Canada Ltd., B-C mine.	Eug. Medardi. . . .	—	Labourer. . . .	Left leg bruised when struck by rolling stone in open cast pit.

NON-FATAL ACCIDENTS 1971

No	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Accident
138	Aug. 10	Asbestos Corporation of Canada Ltd., King mine.	Ov. Grondin. . . .	—	Labourer. . . .	Cut to right hand when struck by piece of rock in open cast pit.
139	Aug. 15	Asbestos Corporation of Canada Ltd., B-C mines	G. Cechire.	—	Labourer. . . .	Little finger right hand bruised when caught between rock and cable-derrick box in open cast pit.
140	Aug. 17	Asbestos Corporation of Canada Ltd., King mine.	Alex. Benard. . . .	—	Cobber.	Left hand injured when piece of crude fibre cut into palm of his hand.
141	Aug. 30	Canadian Johns-Manville Co. Ltd.	Henry Côté. . . .	—	Foreman. . . .	While directing a man to break a rock with hammer piece of rock flew up and hit on right eye cutting corner and causing severe conjunctions.
142	Aug. 30	Asbestos Corporation of Canada Ltd., King mine.	Ludger Couture. . .	—	Millhand. . . .	Tip of third finger cut off when caught under heavy shaft.
143	Sept. 5	Asbestos Corporation of Canada Ltd., King mine.	Henri Boudreault. .	—	Labourer. . . .	Sprained his right foot in helping to place a cable-derrick steel box in bottom of open cast pit.
144	Sept. 9	St. Laurent Quarry Ltd.	Hector Clement. . .	32	Foreman. . . .	While loading a hole with dynamite a premature blast occurred resulting in the lost of four fingers of left hand and burns on right hand.
145	Sept. 10	Asbestos Corporation of Canada Ltd., King mine.	W. Laroche. . . .	—	Millhand. . . .	Right hand cut by stone falling from bucket elevator in crushing plant.
146	Sept. 13	Bell Asbestos Mines.	F. Lemieux.	60	Labourer. . . .	Fracture of bone of right knee while jumping from a platform on some stones.
147	Sept. 13	Asbestos Corporation of Canada Ltd., B-C mine.	Alfred Côté.	—	Labourer. . . .	Cut to left hand when struck by falling piece of rock in open cast pit.
148	Sept. 17	Asbestos Mines Limited.	Joseph Moisan. . .	28	Labourer. . . .	Painful contusion of right shoulder when thrown on floor of store-shed by a row of bags rolling from pile.
149	Sept. 17	Canadian Johns-Manville Co. Ltd.	T. Gauthier.	—	Bagger. . . .	Infected wound in left hand, caused by bag holder on frame while bagging fibre.
150	Sept. 21	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	F. Gauthier. . . .	33	Labourer. . . .	Severe contusion of left leg when struck by a large piece of rock falling from side of open cast pit.
151	Sept. 22	Asbestos Corporation of Canada Ltd., King mine.	Damase Gagné. . .	—	Labourer. . . .	Right knee injured when struck on knee by rolling stone in open cast pit.
152	Sept. 24	Asbestos Corporation of Canada Ltd., King mine.	Auguste Bois. . . .	—	Labourer. . .	Toe of left leg fractured by rock rolling from side of open cast pit.

153	Sept. 26	AAsbestos Corporation of Canada Ltd., B-C mine.	G. Bonnevonato.	—	Labourer.	Legs bruised by rock falling on his legs when at work in open cast pit.
154	Sept. 27	Bell Asbestos Mines.	Nap. Simard.	51	Labourer.	Right knee injured by small stone rolling from jam in open cast pit.
155	Sept. 27	Canadian Johns-Manville Co. Ltd.	W. Morin.	—	Labourer.	Wound on top of head when struck by piece of rock which fell from dipper of steam shovel.
156	Oct. 2	Canada Cement Co., Ltd. Plant No 1.	G. de Tomasso.	—	Crusherman.	Amputation of a finger and laceration of another : Struck on hand while helping to drive home spur gear of crusher.
157	Oct. 4	Bell Asbestos Mines.	L. Vermette.	35	Labourer.	Right thumb bruised when caught between ends of two rails in laying tracks.
158	Oct. 6	Asbestos Corporation of Canada Ltd., King mine.	Joseph Camden.	—	Labourer.	Wound to right leg inflicted by rolling stone.
159	Oct. 10	National Brick Co. of Laprairie Ltd.	Emilio Boni.	—	Labourer.	Cut on scalp and small cut under right nostril when struck by a clay car as contents were being emptied at the pan.
160	Oct. 11	Asbestos Corporation of Canada Ltd., B-C mine.	Onésime Rousseau.	—	Labourer.	Finger bruised when piece of iron fell on it.
161	Oct. 19	Asbestos Corporation of Canada Ltd., B-C mine.	Thos. Bolduc.	—	Labourer.	Right hand injured by piece of fibre.
162	Oct. 19	Canadian Johns-Manville Co. Ltd.	Erwin Gifford.	—	Electrician.	Scratched hand on copper wire, resulting in blood poisoning.
163	Oct. 29	Asbestos Corporation of Canada Ltd., King mine.	Alphonse Goudreau.	—	Millhand.	Wound to finger of right hand caused by belt in motion in mill.
164	Nov. 4	Canadian Johns-Manville Co. Ltd.	Sheldon Hamilton.	—	Foreman.	Slight wound on left wrist became inflicted.
165	Nov. 5	Johnsons' Company.	O. Vaillancourt.	76	Carpenter.	Amputation of little finger of left hand when nut was caught by knife of buzz planer from which he had removed safety guard.
166	Nov. 7	Maple Leaf Asbestos Corporation Ltd.	Aristide Huard.	—	Labourer.	While injured was loading a large rock into his cable derrick box, he caught his hand between the rock and side of box, crushing his hand, and cutting the fourth finger of the left hand.
167	Nov. 8	Canadian Johns-Manville Co. Ltd.	Francis Gervais.	—	Fireman.	Cinder from locomotive lodged in his left eye.
168	Nov. 8	Quebec Asbestos Corporation.	Joseph Fradette.	35	Carpenter.	Fell fifty feet into bottom of open cast pit.
169	Nov. 9	Slate Products Co. of Canada Ltd.	D. Fontaine.	44	Fireman.	Two ribs fractured when he slipped on icy roof of boiler room.
170	Nov. 9	Consolidated Asbestos Ltd.	Harry Stevenson.	—	Millhand.	While on round of inspection at night the injured man in the darkness fell down an opening from the first to the ground floor and strained his back.

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No.	Date	Name of Operator	Name of injured	Age	Occupation	Nature of Wound and Cause of Accident
171	Nov. 11	Asbestos Mines Ltd.	Al. Bisson.	—	Labourer. . . .	While cleaning drum of convey or belt he fell and his right leg was caught between the belt and the frame. The leg was twisted and crushed, the knee and ankle were dislocated.
172	Nov. 11	The Pennington Asbestos Co. .	Victor Rochette. . .	—	Labourer. . . .	Had two ribs fractured when man was caught in slide of rock in open cast pit.
173	Nov. 18	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	Joseph Lemay. . . .	23	Labourer. . . .	While lefting a heavy rock he strained his back.
174	Nov. 18	Canadian Johns-Manville Co. Ltd.	Howood Loxon. . .	22	Brakeman. .	Cinder from locomotive lodged in his right eye.
175	Nov. 19	Canadian Johns-Manville Co. Ltd.	Claude Lamb. . .	39	Mechanic. . .	Right foot crushed by fall of heavy crowbar he war carrying.
176	Nov. 21	Bell Asbestos Mines.	Joseph Leaf. . . .	41	Labourer. . . .	When erecting timber caps in tunnel, one fell on his right knee spraining same.
177	Nov. 21	Maple Leaf Asbestos Corporation	Frank Tetreault. . .	30	Labourer. . . .	Rail fell on foot causing abrason of skin and contusion of large toe.
178	Nov. 21	Canadian Johns-Manville Co. Ltd. Ltd.	Joseph Morency. . .	—	Labourer. . . .	Had left hand crushed between a large rock and side of cable derrick box in open cast pit.
179	Nov. 21	Maple Leaf Asbestos Corporation Ltd.	Albanie Lafrance. .	—	Labourer. . . .	While breaking a rock with a sledge hammer, a splinter entered the man's left eye, causing abrasion and severe inflammation.
180	Nov. 24	Bell Asbestos Mines.	A. Dupont.	32	Labourer. . . .	Left side injured by fall of gin pole while at work on surface.
181	Nov. 25	Canadian Johns-Manville Co. Ltd.	V. Gagnier.	—	Driller. . . .	Scratched back of left hand.
182	Nov. 25	Maple Leaf Asbestos Corporation Ltd.	Aug. Roy.	—	Dumper. . . .	Owing to hoist commencing to run while this man was greasing carriage, his left hand was crushed between the sheave and the cable.
183	Nov. 29	Slate Products Co. of Canada Ltd.	Paul Cadorette. . .	—	Crusherman. .	While hoisting timber some pieces fell on his foot.
184	Nov. 29	The Pennington Asbestos Co. .	J.-B. Cote.	—	Labourer. . . .	While loading a cable derrick box in bottom of open cast pit, he slipped and fell inflicting painful injures to side.
185	Dec. 1	Asbestos Corporation of Canada Ltd., King mine.	M. Martel.	—	Labourer. . . .	Leg bruised when struck by stone rolling from jam.

186	Dec. 3	Asbestos Mines Ltd.	Arthur Paré.	25	Labourer.	While at work at receiving station on serial tramway line a bucket fell crushing a finger.
187	Dec. 5	Asbestos Corporation of Canada Ltd., King mine.		—	Labourer.	Left eye injured by stone rolling from jam in open cast pit.
188	Dec. 9	Bell Asbestos Mines.	J. Blanchette.	52	Labourer.	A large piece of rock rolled from jam and struck him on his right leg.
189	Dec. 12	Asbestos Corporation of Canada Ltd., King mine.	Alex. Benard.	—	Labourer.	Fell pain in stomach while lifting a heavy stone.
190		Bell Asbestos Mines.	Wilfrid Carrier.	30	Labourer.	Right arm contused above elbow when struck by stone rolling from the jam.
191	Dec. 13	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	Jos. Remillard.	13	Labourer.	Contusion on right foot stone fell on his feet while loading crane box.
192	Dec. 14	Asbestos Mines Ltd.	L. Charpentier.	26	Driller.	While walking up to the bin on the trestle he fell through the ties hurting his right side.
193	Dec. 15	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	Geo. Camire.	62	Labourer.	While excavating for a boiler house he fell, bruising his body.
194	Dec. 15	Asbestos Corporation of Canada Ltd., King mine.	Cyrille Bisson.	—		Left hand injured by fall of rock from ore-bin air surface.
195	Dec. 19	Consolidated Asbestos Ltd.	L. Ainsley.	—	Mechanic.	While sharpening a chisel on emery wheel piece of emery flew into his left eye.
196	Dec. 19	Slate Products Co. of Canada Ltd.	A. Champagne.	40	Labourer.	Slipped while lifting a piece of timber and rupture himself.
197	Dec. 21	Bell Asbestos Mines.	P. Pommerleau.	36	Milwright.	While lifting a stone with winch, the handle hit his right elbow bruising it.
198	Dec. 22	Johnsons Company.	W. Wright.	—	Brakeman.	Thumb of right hand crushed in coupling cars.
199	Dec. 28	Asbestos Corporation of Canada Ltd., King mine.	G. Wittebold.	—	Labourer.	Cut of scalp when rope fell on his head.
200	Dec. 29	Asbestos Corp. of C. Ltd., B-C mine.	G. Bellavance.	—	Labourer.	Right arm and shoulder bruised struck by rock falling from jam.
201	Dec. 31	Asbestos Corporation of Canada Ltd., King mine.	W. Bois.	—	Labourer.	Right leg fractured by piece of rock rolling from the jam.

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